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MSS. Intended for publication and books, etc., intended for review should be sent to the Editor of SCIENCE, Garrison-on-Hudson, N. Y.

ZOOLOGY AT THE NEW YORK MEETING

I

AT the convocation week meetings held in New York, December 27, 1906, to January 2, 1907, Section F of the American Association for the Advancement of Science and the Eastern Branch of the American Society of Zoologists held joint meetings throughout for the reading of papers. In the forenoon of Friday, December 28, there was a joint session of these two societies with Section G, devoted to papers on animal and plant breeding, and in the afternoon of the same day the societies joined with the American Society of Naturalists in a discussion on the biological significance and control of sex, which has been published in full in SCIENCE for March 8. Section F and the Society of Zoologists held separate business sessions, the proceedings of which follow.

SECTION F

A business meeting was held December 27 for the election of officers, and the section was represented in a committee of the council which recommended the appointment by the president of the association of a committee to arrange a suitable memorial of the fiftieth anniversary of the publication of the 'Origin of Species.' The officers for the ensuing year are as follows:

Vice-president and Chairman—E. B. Wilson, New York.

Secretary—C. Judson Herrick, Granville, Ohio.

Member of Council—Herbert Osborn, Columbus.

Member of General Committee—E. L. Rice, Delaware, Ohio.

Sectional Committee—E. B. Wilson, E. G. Conklin, C. Judson Herrick, H. B. Ward (one year), Frank Smith (two years), W. E. Ritter (three years), A. M. Bleile (four years), A. L. Treadwell (five years).

AMERICAN SOCIETY OF ZOOLOGISTS

The fourth annual meeting of the Eastern Branch and the seventeenth annual meeting of the society since its establishment as the American Morphological Society elected the following officers for 1907:

President—Charles B. Davenport.

Vice-president—F. H. Herrick.

Secretary-Treasurer—H. E. Crampton.

Member of Executive Committee (to serve three years)—W. R. Coe.

Eleven persons were elected to membership, making the total membership of the Eastern Branch 135. A grant of \$125 was voted toward the expenses of the International Zoological Congress to be held in this country next August.

Professor Crampton tendered his resignation as secretary-treasurer, and after adjournment of the session C. Judson Herrick was appointed by the executive committee to fill the vacancy.

JOINT PROGRAM

The Functions of the Nervous System of the Razor-shell Clam: G. A. DREW, University of Maine.

On the Sense of Sight of Spiders: A. PETRUNKEVITCH, Indiana University.

The Sense of Vision in the Dancing Mouse: ROBERT M. YERKES, Harvard University.

That brightness vision is fairly well developed in the dancer is shown by its ability to discriminate blacks, grays and whites. Color vision is extremely poor. There is some indication of the discrimination of

red and green and of red and blue, but none whatever of blue and green. All my experimental tests as well as my observations of the habits of the mouse support the conclusion that such visual guidance as is received results from stimulation by brightness differences. There are many reasons for believing that the red end of the spectrum is much lower in brightness value for the mouse than for man. The general behavior of the dancer and the results of form, brightness and color tests show that vision is not very important in the life of the animal.

An Experimental Study of the Image-forming Powers of Various Types of Eyes: LEON J. COLE, Rhode Island Agricultural Experiment Station, Kingston, R. I.

The responses of certain phototropic animals to two areas of light of different size, but of equal intensity, were used as criteria in drawing inferences as to the image-forming powers of their eyes. To one side was a ground-glass, lighted from behind, which gave an evenly illuminated area 41 cm. square. To the other side was practically a point of light; but at the position midway between them, where the experiments were performed, the intensities of the two lights were equal. Eyeless forms (the earthworm was used) turned practically an equal number of times toward each light, showing no power of discriminating between them. Animals with 'direction eyes' were but little better in this respect (e. g., *Bipalium*, *Oniscus*, larva of *Tenebrio*). On the other hand, animals with well-developed 'compound eyes' (*Vanessa*, *Ranatra*) and 'camera eyes' (frogs) discriminated readily, positive animals turning much more often to the large light, and negative animals more often to the small. This discrimination was taken as evidence of image-formation by the eyes. Frogs

(*Acris gryllus*) with the skin covered but eyes exposed reacted like normal frogs; without the use of the eyes their responses corresponded to those of the earthworm.

We have thus a physiological test of the image-forming powers of the eyes, and in these experiments it corroborated in the main inferences which would be drawn from a study of the structure of the eyes in question.

This paper is published in Proc. Am. Acad. Arts and Sciences, Vol. 42, No. 16, pp. 335-417, Jan., 1907.

The Significance of the Grasping Antennæ of Male Harpacticoid Copepods: L. W. WILLIAMS, Harvard Medical School.

This paper has been published in SCIENCE for February 8.

Further Observations on the Behavior of Tubicolous Annelids: CHAS. W. HARGITT, Syracuse University.

Following up the work done on these animals and reported elsewhere, the writer has extended the observations to aspects of behavior other than those already recorded. Three points are concerned in the following observations:

First, a study of behavior under natural conditions of environment. This has been possible in quiet pools near low tide lines. Experiments on *Hydroides dianthus* with shadow stimuli, or light intensity of varying degree, under these conditions have confirmed in all essentials those made last year.

Experiments as to tactile responses showed considerable variations as compared with the former series. This may be attributed to the fact that specimens living under these conditions become more or less inured to similar stimuli from the actions of waves which naturally buffet them almost constantly.

Second, experiments on the relative sensory acuteness of specimens from deep

water, about twenty fathoms, compared with those from shallow waters, one to three or four fathoms. In cases tested there was shown a definite preponderance of positive reactions among the latter, and a corresponding preponderance of negative responses in the former.

Third, a comparative study of the aspects of behavior shown in the growth of colonies taken from shore waters, subject to the action of waves, and those from quiet waters of bays, etc., shows an unmistakable variability in the aspects of the tubes, which clearly indicates environmental adaptation. Furthermore, specimens growing in an environment, such as marly bottom, or silt, or other similar condition, show the same evident response of adaptation. On the other hand, specimens growing along shore lines, or on rocky bottoms, show likewise the unmistakable response natural to such condition. Not a single colony among hundreds along the shore lines showed any free and vertical tubes. Likewise specimens dredged from muddy bottoms showed the erect and vertically directed tubes which would bring the animals above the obstructing mud.

Any careful consideration of the facts would hardly fail to convince one that no single factor, such as heliotropism, or geotropism, or any other tropism alone, was adequate for their explanation.

Rhythical Pulsation in Animals: ALFRED G. MAYER, Carnegie Institution of Washington.

Experiments made at the Tortugas Marine Laboratory of the Carnegie Institution upon *Cassiopea*, *Salpa*, *Lepas* and the loggerhead turtle give results as follows:

Rhythical pulsation can be sustained only when a strong stimulus is counteracted by an inhibitor, so that the pulsating organism is maintained at or near the threshold of stimulation in a state analo-

gous to that of unstable equilibrium, thus allowing weak internal stimuli to produce recurrent movement.

In the lower marine animals the NaCl, calcium and potassium of the sea-water combine to form a powerful stimulant, which if unchecked would produce only sustained tetanus, but the magnesium overcomes this effect by its anesthetic (diastolic) influence.

The pulsating organs of terrestrial animals are also stimulated by optimum combinations of NaCl, with potassium and calcium, and this is held in check by a definite proportion of magnesium.

A Ringer's solution resembles this optimum combination of NaCl, calcium and potassium, and is only a stimulant, not an inorganic food. It must be counterbalanced by magnesium in order to enable it to sustain pulsation indefinitely.

In *Cassiopea* any paralyzed strip of sub-umbrella tissue, cut in the shape of a closed circuit, will remain indefinitely in rhythmical pulsation, if once a contraction wave be started in the circuit. Every time this wave returns through the circuit of tissue to the place whence it started, it is re-stimulated and sent forth anew, and being thus reinforced at each return it is sustained indefinitely.

In the scyphomedusa, *Cassiopea*, the diffuse nervous or epithelial elements of the sub-umbrella transmit the pulsation stimulus to which the muscles respond by contraction.

The peripheral muscular layer of the wall of the loggerhead turtle's heart is the only part actively concerned in the rhythmical movement, and the internal cavernated mass of the heart's tissue may be removed without checking the pulsation. This peripheral part of the muscular wall of the heart tends to maintain itself in pulsation very much as will circuits made of the sub-umbrella tissue of *Cassiopea*.

The pulsation-stimulus acts solely upon the peripheral muscular layer of the heart's wall, the inner cavernated tissue remaining passive.

The above is a brief review of Publication No. 47 of the Carnegie Institution of Washington, 'Rhythmical Pulsation in Scyphomedusæ,' 1906.

The Interrelation of Sensory Stimulations in Amphioxus: G. H. PARKER, Harvard University.

To weak acid solutions and other like mixtures the anterior end of *Amphioxus* was found to be most sensitive, the posterior end less so, and the middle trunk region least sensitive. To the pressure of a camel's hair brush, the middle region was less sensitive than the two ends, which, however, were not distinguishable one from the other by this method of stimulation. To a current of warm water (40° C.) the anterior end was most sensitive, the middle less, and the posterior end least. There were no reactions to a current of cold water (2° C.). To a fine beam of strong sunlight, previously passed through water to eliminate heat, the anterior end including the 'eye spot' was not sensitive, the region immediately behind the 'eye spot' was most sensitive, the posterior region slightly less so and the middle region least so.

The distribution of sensitiveness to light corresponds to the distribution of the pigment cups in the central nervous organ and these cups are without doubt the mechanisms concerned with the reception of light. The distributions of the other classes of sensitiveness are in mutual agreement, and, from the nature of their stimuli, these classes are doubtless represented by integumentary nerve terminals. To what extent these classes are independent may be inferred through the effects of exhaustion. After the tail of *Amphioxus* has been repeatedly stimulated with weak acid, the

animal ceases to respond to this stimulus but is still normally sensitive in that part of its body to heat or to mechanical stimulation. In a similar way after exhaustion to mechanical stimulation or to heat stimulation, the particular part of the body experimented upon is still sensitive to the other classes of stimuli. Exhaustion to light stimulation has no effect upon the sensitiveness to the other classes of stimuli. These observations lead to the conclusion that light, heat, mechanical and chemical stimuli are received by physiologically separate mechanisms and that these mechanisms are located in the skin except in the case of light, whose receptive organs are the pigment cups in the central nervous organ.

Analysis of the Cyclical Instincts of Birds:

FRANCIS H. HERRICK, Western Reserve University.

The behavior of wild birds is primarily determined by a number of commanding instincts of ancient origin. These cardinal instincts are of two kinds, namely: (1) *continuous instincts*, which are needed for the preservation of the individual, such as preying, fear, concealment and flight, and (2) *cyclical instincts*, which are necessary for the maintenance of the race. By cyclical instincts we mean those discontinuous, recurrent impulses which attend the reproductive cycle, and which may be described as parental instincts.

The cyclical or parental instincts as a rule recur with almost clock-like precision, in spring or summer, with repetitions within the breeding season in certain species. They are modified by the continuous instincts, such as fear, and the instinctive behavior as a whole is liable to modification at every point by intelligence. Neglecting such changes for the present, we will briefly analyze the cyclical in-

stincts, reserving details and tabular statements for a fuller presentation.

The reproductive cycle is made up of a series of terms, representing discrete acts or chains of actions which follow in a definite succession. Eight or more terms may be recognized, many of which, such as brooding and feeding the young, are recurrent within the series. The cycle may be graphically represented by a number of tangent circles, each one of which stands for a distinct sphere of influence, or subordinate series of related impulses, named and numbered as follows: (1) Spring migration; (2) courtship and mating (often attended by song); (3) selection of nesting site and building nest (often accompanied by the fighting instinct); (4) egg-laying; (5) incubation—including care of eggs, such as shielding, rolling, cleaning and covering (fear often completely blocked by brooding instinct); (6) care of young in nest, subject to the following analysis: (a) feeding young, including capture and treatment of prey, return to nest (pause), call-stimulus, testing reflex response of throat, watching for reflex response (pause); (b) inspection of young and nest; (c) cleaning young and nest; removal and disposition of excreta; (d) incidental care of young and incidental behavior in this and other terms of cycle, such as brooding, shielding or spreading over young whether sitting or erect, bristling and puffing, preening, gaping, stretching and yawning, guarding and fighting; (7) care and incidental education of young when out of the nest; guarding, feeding, play, and other instinctive acts; (8) fall migration. Beginning at 2, 3 or 4, according to circumstances, the cycle may be repeated once or oftener within the season.

The coordinated instinctive responses of the young begin in the sixth term, and are mainly as follows: (6) Initial responses at moment of hatching or shortly after,

including grasping movements of limbs, elevation of head, opening of mouth, and the swallowing reflex in response to contact of bill of old bird or of food in deep part of throat (in the altricial species); characteristic actions in muting following feeding, in response to the stimulus of food and the attitude of inspection in adult; call-notes, pecking and gaping, stretching and spreading in response to heat, flapping, fear and flight; (7) calling (teasing), following, crouching and hiding, play, imitation, preying and flight; (8) fall migration.

The formula of the reproductive cycle given above is a composite, which with slight changes will apply to most of our common wild birds. In the most aberrant cases of behavior, where the parental instincts have been reduced to a minimum as in the cow buntings of North America and in some of the megapodes, the cycle ends abruptly with term 4, and in the cowbird there is no attempt to either build a nest or to conceal the eggs.

Some Features in the Behavior of the Starfish: H. S. JENNINGS, Johns Hopkins University.

The paper gave an analysis of the righting reaction of the starfish, and showed that the animal could, by a systematic course of training, be caused to form a habit of righting itself in a certain definite way.

Movement and Problem-solving in Ophiura brevispina: O. C. GLASER, University of Michigan.

1. *Ophiura brevispina* moves in practically all of the ways possible to a pentaradiate animal.

2. Its behavior in removing obstructions from its arms is not perfected by practise under ordinary conditions.

3. Preyer's conclusion that Ophiurans are intelligent is not substantiated by this

study; for not only is it impossible to demonstrate 'resolution' or improvement, by the method that he employed, but the assertion that an animal is intelligent because when stimulated it performs varied movements until some one of these brings about cessation of the stimulus, leads into difficulties, for these animals often perform in instantaneous succession movements that fail for the same reason. *Ophiura*, moreover, hardly ever executes a single movement, but usually a considerable number. Each of these on Preyer's view results in learning, but it is impossible without striking evidence to the contrary, to believe that Ophiurans can learn half a dozen things at the same time. If some of all the movements performed at a certain instant are 'correct,' the case is farther complicated in that some of all the things which the animal learns fall into the category of successes, some into the category of failures.

4. The reason why *Ophiura brevispina* does not improve under ordinary circumstances is probably due to its versatility. This animal can perform a surprising number of movements. Of all these some are better fitted to meet a certain difficulty than others, but a considerable number will serve the purpose. Where the number of solutions to a problem is large, it is not surprising that no particular method of solution should be perfected, viz.: that resolution should not occur.

The Breeding Habits of the Florida Alligator: ALBERT M. REESE, Syracuse University.

The habits of the alligator were studied during parts of three summers in the Everglades, in the swamps of central Florida, and in the Okefenokee Swamp. The time of laying is the month of June, usually during the second and third weeks. The nests, which are built on the bank near

the caves of the alligators, vary considerably in size, and consist of a very compact mass of damp, decaying vegetation. They probably serve more as a means of keeping the eggs moist and at a constant temperature than as a means of heating them. The average number of eggs in a single nest is about thirty, forty-eight being the greatest number found in one nest. The eggs are so closely packed in the nest that it seems hardly possible that the young alligators, on hatching, should be able to dig their way out; it is possible that the female who laid the eggs may hear the noise made by the young before hatching and may dig them out of the nest before they suffocate. The period of incubation is probably about eight weeks, and sometimes is found to have begun before the eggs are laid, so that eggs taken directly from the oviducts may contain well advanced embryos. There is considerable variation in the size of the eggs, the variation in long diameter being greater than that in short diameter. The average long diameter of the four hundred eggs measured was 73.742 mm. The average short diameter was 42.588 mm.

An Electric Wax-cutter for Use in Reconstructions: EDWARD L. MARK, Zoological Laboratory, Harvard University.

The wax-cutter is made by heating a platinum wire about 0.4 mm. in diameter by means of an electric current regulated by a rheostat consisting of ordinary electric lamps of different candle power and arranged in multiple. To give the wire alternating motion parallel to its length, it is stretched in a frame made of a bent steel rod, one portion of which is substituted for the 'needle-bar' of an ordinary household sewing machine. The melted wax is withdrawn through a copper tube—kept hot by passing through a small

hot-water tank—attached to a suction pump of the Bunsen type.

The apparatus is fully described and illustrated in a number of the *Proceedings* of the American Academy of Arts and Sciences published in March.

The Microscopic Structure of the Stigmal Plates of the Tick Genus Dermacentor:
C. W. STILES, Washington, D. C.

The Circulatory System in Nereis: H. R. LINVILLE, New York.

The general plan of the circulatory system and the circulation in *Nereis*, as observed in living individuals, is a median dorsal vessel in which the blood flows anteriorly as the result of peristaltic waves of contraction in the wall of the vessel, and a larger median ventral vessel in which blood flows posteriorly without contraction of the wall. Anteriorly the dorsal vessel branches at the cephalic plate into four vessels, and the blood is carried downward and posteriorly through a set of capillaries in the region of the pharynx to the ventral vessel. Posteriorly the last three somites of the trunk have single pairs of blood vessels which carry blood upward into the dorsal vessel. Beginning at the eleventh trunk somite and extending to the fourth somite from the posterior end, there is a complicated arrangement of lateral vessels and capillaries. At a point near the anterior end of each intermediate somite a pair of 'hearts' lying close to the intestine carry blood downward in peristaltic waves, to a pair of short vessels which connect with the ventral vessel. A portion of the blood carried by the hearts passes into these short connecting vessels, and then into the ventral vessel or out into another pair of blood-vessels that start from the ventral ends of the short connecting vessels and extend to the nephridia in the ventral rami of the parapodia. The remainder of the blood from the hearts goes into a pair

of vessels, which are continuous with the hearts but bend outward and upward and pass through the dorsal musculature into the somite in front, to sets of skin capillaries there on the dorsal rami of the parapodia and on the dorsal surface of the somite. Blood passes through these sets of capillaries, with the blood from the nephridial capillaries, into a pair of vessels which empty blood into the dorsal vessel immediately after the peristaltic wave of contraction in the dorsal vessel has passed the point of connection.

*The Relation of Variability to Food Supply as illustrated by the white daisy, *Chrysanthemum leucanthemum* L. and the yellow perch, *Perca flavescens* Mitch.:*

L. B. WALTON, Kenyon College.

Notwithstanding the numerous biological problems which have been attacked by means of statistical methods during the last ten years, an absence of evidence concerning the effect of food supply upon the variability of organisms exists. It was with a view toward obtaining data bearing upon this particular problem that the present investigation was undertaken. While the natural environment by no means furnishes conditions for obtaining the best results, it seemed advisable, at least in a preliminary survey of the subject, to adopt such a method.

In the first part of the investigation results were obtained from the ray flowers in two groups of the common white daisy (*Chrysanthemum leucanthemum* L.), 500 heads growing on rich soil (group A) and 500 heads growing on poor soil (group B) were examined. The specimens were collected on the same day and from localities approximately one mile apart. While the mode (33) and the mean (28.786) were much greater in specimens growing on rich soil (cf. Ludwig, Tower, Shull, etc.) than in those on poor soil (21) (25.632), the

index of variability in each group was approximately the same taking into consideration the probable error.

In the second part of the investigation results were obtained from the number of pore-bearing scales in the lateral line of two groups of yellow perch (*Perca flavescens* Mitch.) obtained in Lake Erie. The one group (group A) was procured from a locality (cove in Sandusky Bay) where there was every reason to believe that the food supply approached the maximum, while the other (group B) was collected from the rocky shores of an island some ten miles distant where the food supply apparently approached the minimum. Again the index of variability showed no decided difference when the probable error was considered.

In connection with the ray flowers of the daisy it is of interest to note that specimens from rich soil exhibited a tendency toward an even number of ray flowers, while those from the poor soil had a tendency toward an odd number of ray flowers. This however may be a coincidence, although taken into consideration with the differences, a somewhat remarkable one. No decided tendency toward the Fibonacci series was apparent.

The computations were made by the ordinary method, checked by logarithms and a Burrough's adding machine. There are a number of possible errors minimizing the value of the results. These, together with the literature bearing upon the subject will be considered in the final paper.

While the above results suggest that food supply does not materially affect variability, it is evident that work upon a larger number of specimens, as well as carefully controlled experimental investigations, where the effects of different groups of stimuli may be segregated, will be necessary before any final conclusions may be drawn.

A Study in Variation, Geographical Distribution and Mutation in Snails of the Genus Partula from Tahiti: H. E. CRAMPTON, Columbia University.

In presenting the more important results of a recent study in the field of terrestrial pulmonates of the island of Tahiti, belonging to the genus *Partula*, it was shown that different valleys contain forms that on account of their more or less complete isolation have come to differ in correlation with their geographical proximity or remoteness. The vital conditions that limit the snails of this island to their particular stations are dryness peripherally, where the valleys debouch upon the coastal alluvial plain, and lower temperature centrally. Only rarely may stragglers pass from one region to another.

Evidence was adduced showing that 'mutations' have arisen at various recent times, the observations of Garrett and Mayer, taken in connection with the results of the writer, making it certain that at least three forms have thus originated, at dates that may be determined with substantial accuracy. It was furthermore shown, in corroboration of Mayer's contention, that the environmental conditions can not be regarded as the factors that have produced the several specific and varietal differentia exhibited by the Tahitian snails.

On a Case of Reversion induced by Cross-Breeding and its Fixation: W. E. CASTLE, Harvard University.

This paper has been published in SCIENCE of January 25.

Reversion: C. B. DAVENPORT, Cold Spring Harbor, Long Island.

Observations on the Habits of Salt Marsh Mosquitoes: JOHN B. SMITH, New Brunswick, N. J.

During the summer of 1906 a close watch was maintained on the development of

mosquitoes on the salt marsh area near Elizabeth, New Jersey. In all ten distinct broods developed, the first observed April 19 and coming to maturity May 2; the tenth observed October 12 and coming to maturity soon after. Larvæ were found however until November 30 after even heavy frosts. Broods I., II. and III. were mostly *Culex cantator*; in brood IV., *C. cantator* and *C. sollicitans* were almost equal; brood V. had 80 per cent. *cantator*, and after that *C. sollicitans* was in the majority in all cases. The latest larvæ, however, were *cantator*. There was a great difference in the habits of the various broods: I., II., IV. and VI. were migrants and left the marshes in great numbers; the others remained on the marshes or did not get very far inland. There seemed to be a relation between numbers and migrations, the heavy broods migrating most and farthest.

An Undescribed Species of Noctuid Moth from New York City: HENRY BIRD, Rye, New York. Illustrated by box specimens showing larvæ and habits.

New Evidence from Primitive Sharks on the Origin of the Limbs of Vertebrates: RAYMOND C. OSBURN, Columbia University.

Embryological studies on *Heterodontus japonicus* Dumeril, a cestriont, and on *Chlamydoselachus anguineus* Garman, a notidanid shark, show that there is a deep-seated, primary similarity between the paired and unpaired fins embracing all the structures of the fins—skeleton, muscles, nerves, blood supply and ceratotrichia. The arguments recently advanced by the gill-arch theorists for the branchial origin of the paired limbs (viz., abortive muscle-buds, fusion of muscle-buds, collector nerves, discrepancy between muscle and fin rays, and fin-migration) are all disposed of by showing that these conditions may

exist in any fin, unpaired as well as paired. The pectoral girdle is proved to be not serially homologous with the gill arches. In *Heterodontus* the pectoral girdle is shifted forward during development toward the gill region instead of away from it as the gill-arch theory assumes. The attachment of the trapezius muscle, assumed by the adherents of the gill-arch theory to be 'an old relic of a former branchial musculature supplying the shoulder girdle,' is shown instead to be secondary. The pelvic arch has primarily no dorsal prominence homologous with the scapular portion of the pectoral arch, but, on the other hand, the pectoral arch passes through a stage similar to the pelvic arch when only the ventral portion is present. Hence neither of them is to be regarded as a modified gill arch. In all fins the condensation or thickening of the mesenchyme, from which the skeleton is later differentiated, begins always in the fin-fold in contact with the ectoderm and extends inward, and is thus of external origin in contrast to that of the gill arches which arises next to the endoderm of the pharynx. In the paired and unpaired fins the sequence of development of the various structures is identical. The above facts show such striking similarity between the paired and unpaired fins, in the development of all structures, and such contrast with the gills, as to strongly support the fin-fold theory of Thacher, Balfour and Mivart.

On the Structure, Development and Relationship of Blastoidocrinus (Billings 1859): GEORGE H. HUDSON, Plattsburgh, Clinton Co., N. Y.

The only known species of the genus was described by Billings in *Cam. Org. Rem.*, Decade IV. (1859). F. A. Bather in Part III. of the 'Treatise on Zoology'

edited by E. Ray Lancaster gives it a family of its own and has placed it with *Asteroblastus* under Grade A, *Protoblastoidea* Bather (1899). The elaborate hydrosphere folds would cut it out of this grade, however, and while it has an ambulacral system like that of the Edrioasteroidea its brachioles would alone exclude it from that class. The present paper is based on a very perfect specimen (fragments only have been heretofore known), and on fragments and some thousand single and very perfect plates from specimens of different ages. The paper presents new and remarkable elements in Echinoderm structure, some from internal structures displayed by a section from the perfect specimen, and the development of many structures from five areas of 'primary meristem,' one each at the distal ends of the rays. Cystid, blastoid edrioasteroid and crinoid characters were briefly mentioned. The form has been made the type of a new order *Parablastoidea*. A more complete description is published in N. Y. State Museum Bulletin 107, p. 97.

Notes on the Periodical Literature of the Smaller Domesticated Animals: C. B. DAVENPORT, Cold Spring Harbor, N. Y.

There is a mass of current periodical literature on the domesticated animals that is not taken cognizance of in the zoological bibliographies nor in those of agriculture. Consequently they are unknown to most zoologists. With the revival of scientific interest in breeding this literature becomes of great importance because it tells where stock is to be obtained and because it contains suggestive data on the factors of evolution. Taken together this mass of periodical literature constitutes a history of the current evolution of domesticated animals of the most detailed and intensive sort.

*Origin of the Sperm-center in the Fertilization of *Cerebratulus lacteus*:* NAOHIDE YATSU, Columbia University.

Since the discovery that a cytaster with a centriole may be formed *de novo*, the question has been raised as to whether the sperm-center may not be a cytaster produced by a stimulus exerted by the spermatozoon. This idea has led to the formulation of the chemical 'theory' of fertilization. It has, therefore, become important to examine the origin of the sperm-center. In studying the spermatozoon of *Cerebratulus lacteus* a definite granule was found in the middle piece, which takes a strong haematoxylin stain. After the entrance of the spermatozoon into the egg the middle piece swells up into a vesicle, and faint rays appear centering in the granule in the middle piece. The granule or centriole then escapes from the vesicle and becomes the center of the growing aster. At this moment there is no centroplasm or centrosome around it, the rays reaching the central granule. Later the central ends of the rays become obscure and the centroplasm is accumulated around the centriole. Then the centriole in the centrosome divides into two. But the daughter centrioles soon lose their centrosome and become naked. From this observation three conclusions may be drawn:

1. The centriole is actually introduced into the egg by the spermatozoon, excluding the possibility that the centriole in the sperm-aster arises from the egg.
2. The centrosome is derived from the egg substance.
3. The centrosome is not a permanent organ of the cell as has been thought by some cytologists.

4 Graphic Method of Correlating Fish Environment and Distribution: ALBERT H. WRIGHT, Cornell University.

It is some years since ornithologists saw

the advantages of some graphic means of representing complex bird waves and their coincident relation to physical conditions. In ichthyology, a schematic method whereby fish distribution and environment can be correlated would seem of material aid.

The study of a stream and its fishes involves the consideration of factors so numerous and so diverse and accumulates such a mass of data, that one is almost driven, perforce, to adopt some graphic method to make results appear quickly and clearly.

The chart described, presents the range of each species in the stream and the important physical conditions which obtain, namely: the nature and the configuration of the bottom; the depth at any given point; the surface of the water; the drop in the stream and the current conditions; the altitudes of the mouth, source and all intermediate points; the distances in miles; woodlands, swamps, falls, mill-ponds, dams in use and remains of dams, small and important tributaries and whether from the right or left side, bridges for landmarks, canals, stream across the divide, the width at any place, at every mile point valley cross-sections in which the geologic formations may be shown, etc.

Venation of the Wings of Paleozoic Dragon-flies: E. H. SELLARDS, University of Florida.

The paper relates specifically to the dragon-flies of the Permian and is a summary of results published in detail elsewhere. The structural characters of especial interest are found in the disposition of the veins of the radio-median area, and particularly in the position of the radial sector, which is observed in the case of a large and well preserved specimen, to cross the first two branches of the media as in the case of modern dragon-flies. The other main veins of this area are also in

essential agreement with the veins of the same area in modern forms. Such differences as occur are believed to be of less than ordinal value. The order Proto-donata, established by Handlirsch, is not accepted; the Protodonates being regarded as a suborder of the Odonata.

Note on the Origin of the Mesoderm of the Polyclad, Planocera inquilina Wh.
FRANK M. SURFACE, University of Pennsylvania.

According to Arnold Lang (1884) the mesoderm of the polyclads arises from the whole of the second and third quartets of micromeres. It had been long suspected that Lang was in error, but the subject was not investigated until 1898 when E. B. Wilson published some observations on a species of *Leptoplana*. He found that all the first three quartets contribute to the formation of ectoderm, while the mesoderm arises by budding in from cells of the second quartet. This mesoderm thus corresponds to the 'larval' mesoderm of annelids and molluses. Wilson, however, found no evidence of mesoderm arising from members of the fourth quartet and thus in this one important particular the early development of the polyclads differed from the above-mentioned groups.

In working over the cell lineage of *Planocera inquilina* it has been definitely determined that in this species, mesoderm arises from the *posterior cell of the fourth quartet*, i. e., *4d*, just as it does in annelids and molluses. At the stage of about forty cells, *4d* buds into the interior a single large cell which later divides into a right and left moiety from which the mesodermal bands arise. Some of the mesoderm, however, arises from cells of the second quartet as described by Wilson.

Land Planarians in the United States: L. B. WALTON, Kenyon College.
Leidy, at a meeting of the Philadelphia

Academy of Science, August 12, 1851, presented a paper in which he described the first and only species of land planarian (excluding *Placocephalus kewensis*, an introduced form living in hot houses) which has thus far been found in the United States. To this he gave the name *Planaria sylvatica*. The five specimens he obtained were collected under flower pots, boxes, etc., in gardens at Philadelphia, and under pieces of bark, and old logs in the woods bordering Wissahicon Creek. On October 7 of the same year, after a more critical study of the specimens, he proposed a new genus for their reception, the name thus becoming *Rhynchodemus sylvaticus*. At a meeting of the society on August 24, 1858, he again referred to the subject stating that since 1851 he had found one specimen in the western part of Pennsylvania on Broad Top Mountain (August, 1857) as well as several specimens at Newport (July, 1858). Since this time no further observations concerning the collection of additional land planarians in the United States have appeared.

Consequently the occurrence of two distinct species of *Rhynchodemus* at Gambier, Ohio, is of considerable interest. The first form which may prove identical with the examples procured by Leidy at Philadelphia, was found on the partially decayed stem of a Virginia creeper, July 9, 1904, near Bexley Hall. Five specimens were obtained, while additional representatives have been found at the same place each succeeding summer. During November of the past year a single specimen was also taken under a stone in a meadow, some three miles south of the preceding locality. The specimens mentioned agree closely with the description given by Leidy as well as with his drawing of the Philadelphia forms published in Girard's paper on planarians (*Ann. sc. Nat. Zool.*, 7 ser., pp. 145-310, 1894). The length is greater

however, while the anterior part is constricted as figured by Girard for the Newport specimens. It is evident that two and possibly three species were confused by Leidy under the one name. His material was given to Girard and thus far it has been impossible to locate it.

The second form occurring at Gambier is considerably smaller than the preceding one as well as much lighter in color. Only two examples have been found, both under stones in damp woods. It seems quite distinct from any of those taken by Leidy as well as the species tabulated by von Graff in his excellent monograph.

Some papers in preparation dealing with the anatomical structure of the forms will probably make clear their systematic position. Furthermore, it appears evident that land planarians are widely distributed over the United States and that by reason of their similarity to young snails, they have often been overlooked by collectors.

Some Little-known Shark Brains, with Suggestions as to Methods: BURT G. WILDER, Cornell University.

This paper continues that of which an abstract was printed in SCIENCE for May 26, 1905. Now first, so far as I know, are shown the brains of *Heterodontus* (*Cestracion*) and *Pristiophorus*. With the former the cerebrum and cerebellum resemble those of the 'acanth' (*Squalus acanthias*), indicating an antiquity little if any greater. Notwithstanding certain ectal resemblances of the two dentirostral genera, *Pristis*, the 'saw-ray' and *Pristiophorus*, the 'saw-shark,' their brains differ markedly, the latter's being the more primitive. Their inclusion within the same family or even the same division would seem to me an error less only in degree than would be their combination with *Xiphias*, *Polyodon* and *Psephurus* as 'Rostrata,' or than was Günther's association of Ganoids and

Selachians as 'Palæichthyes,' aptly characterized by Gill as a 'piece of scientific gaucherie.' Upon encephalic grounds I think *Pristiophorus* and *Scymnorhinus* should be excluded from the Squalidae, and *Sphyrna* from the Carchariidae. The brain of each selachian genus is, I think, recognizable, but I am less certain as to family forms. The Notidanoid or Diplospondylous type is well marked, and includes *Scymnorhinus*. At present the rays can not be distinguished from the sharks in any such simple way as, e. g., the Anura may be from the Urodela by the secondary fusion of the olfactory bulbs. Perhaps, in no shark is the prosocèle so nearly obliterated as it seems to be in all rays. In no ray do the cerebral protrusions remain unjoined as in some sharks; but, paradoxically, in no ray is there, as in several sharks, so nearly a complete obliteration of the evidence of their primary independence. Under 'methods' may be enumerated: (1) The need of well-preserved brains of all species; (2) maintaining the natural contours, especially of thinner parts, by injecting the preservative into the cavities; (3) making solid injections of the cavities; (4) exposing brains with a 'shoe-knife,' obliquely shortened; (5) exploring with the 'syringotome' or canaliculus knife; (6) the use of sheets of uniform size, say 35 x 45 cm., upon which, in a manner permitting change, are drawn outlines of the animal and of its characteristic parts, especially the brain; such sheets may be arranged and rearranged upon the wall so as to facilitate research and exposition to small classes.

The Primary Septa in the Rugose Corals:
CLARENCE E. GORDON, Amherst Mass.

The number of these septa is still in dispute. The assertion of Professor Duerden that there are six protosepta is contradicted by other evidence of an important

nature. Professor Duerden's argument is not conclusive because he has not yet shown in what way a tetrameral plan of growth shown in the early condition of certain individuals can be in all cases the result of imperfect silicification. The possibility of acceleration is not denied and the very species that he studied show strong evidences of acceleration in development. Hence the uncertainty of reasoning from sections, about which there must always be a good deal of doubt.

Early Stages in Streptelasma and Allied Genera: THOMAS C. BROWN, Columbia University.

This paper considers an argument concerning the original tetrameral arrangement of the septæ in *Streptelasma* and allied genera of the rugose corals and describes the protheca as observed in these genera.

Fission in the Hydroid Corymorpha:
HARRY BEAL TORREY, University of California.

Spontaneous fission occurs occasionally in *Corymorpha*, across heteromorphic stems. The latter are geotropic, both ends turning upward, and take the form of U's, attached at the loop, with free vertical limbs. The distal limb is the longer, with the larger and earlier hydranth.

The fission plane is first defined by a constriction in the loop of the U. The stem attenuates in this region, owing to the migration of proximal and distal limbs away from each other. The coenosarcal canals are obliterated and the circulation characteristic of the stem ceases. This may be the cause of the disintegration which may appear here. Frustules arise on both sides of the constriction before fission is completed.

The new polyps, proximal and distal, are normal in all respects. Morphallaxis plays

an important rôle in their complete development.

Variation during the Life-Cycle of Infusoria in its Bearings on the Determination of Species: LORANDE LOSS WOODRUFF, Williams College.

The data summarized, derived from the culture of various infusoria through long periods, suggest that it is customary to regard the structure most frequently observed in 'wild' Infusoria as too constant in character, and to overlook the fact that modifications occur throughout the life-cycle which are in no sense abnormal, and which must be taken into account in the determination of species.

1. *Oxytricha fallax*, for example, shows a variation of over 250 per cent. in length, and over 300 per cent. in width during the life-cycle.

2. The shape of the animal changes greatly at different periods of the life-cycle.

3. The form of the macronucleus alters exceedingly, not only toward the end of the life-cycle but also at periods of the highest reproductive activity. Peculiarities in shape are sometimes transmitted from generation to generation. During a cycle extending over about a year, the macronucleus was 'normal' in form for less than three months.

4. The number of micronuclei varies during the life-cycle. There is apparently a tendency toward numerical reduction during the early part of the cycle, and reduplication during the latter part.

5. The quantitative relation of cytoplasmic and nuclear material changes during the life-cycle. This is brought about by both cytoplasmic, and macro-nuclear and micronuclear changes.

6. The proportionate length of the ciliary apparatus varies, the cilia being longer during high reproductive periods of

the life-cycle. This is probably due to a reduction in size of the body unaccompanied by a proportionate reduction of the ciliary apparatus.

7. The general activity of the organism varies greatly. During periods of high division-rate, motion is exceedingly rapid, and in a general way may be said to diminish with the rate of division.

8. Stimuli produce different effects at different periods of the life-cycle. K_2HPO_4 , for example, accelerated the division-rate of *Gastrostyla steinii* during the early part and retarded it toward the end of the life-cycle.

Notes on the Life History of the Nematode Hæmonchus contortus: B. H. RANSOM, Bureau of Animal Industry, U. S. Department of Agriculture.

Hæmonchus contortus, a nematode worm of the family Strongylidae, which lives parasitic in the fourth stomach of ruminants is responsible for great losses among sheep in the United States, especially among lambs. The lambs become infected, through the medium of the pasture, from the adult sheep of the flock. Full grown sheep may be heavily infested and show little or no evidence of disease. Recent studies in the zoological laboratory of the Bureau of Animal Industry have brought out a number of interesting facts in the life history of *H. contortus*. The eggs of the parasite hatch out in the droppings of the host, and the embryos develop to the final embryonic stage, known as the ensheathed stage, in a period of time varying according to temperature, from three to four days at 95° F., to three to four weeks at 50° F. Ensheathed embryos crawl up perpendicular surfaces whenever the air is saturated with moisture, and by such migrations gain positions on grass blades when they are likely to be picked up by grazing animals. Ensheathed embryos

when swallowed by a sheep develop to maturity in two to three weeks, but eggs and embryos which have not reached the ensheathed stage are not infectious when swallowed. The eggs and newly hatched embryos are quickly killed by freezing or drying, but ensheathed embryos suffer no apparent injury from freezing and may live in a dried condition for at least thirty-five days. When the temperature is 40° F., or below, the eggs remain dormant, and a small percent may retain their vitality for as long as two months, but none survived three months in the experiments tried. Embryos have been kept alive in cultures at a temperature of about 70° F. for as long as six months. Enclosures previously pastured by infested sheep were still infectious after remaining empty for seven months, from November to June. It is suggested that lambs may be kept from becoming infected with the parasite and the flock in course of time freed from infection by moving the flock from one pasture to another before the embryos have time to develop to the ensheathed stage in which they crawl upon the grass, the time being determined by means of cultures of feces from infested animals. Each time the flock is moved a culture is made by placing a small quantity of feces with sufficient water to make a thick paste in a wide-mouthed corked bottle and the culture exposed to out-door temperature. When ensheathed embryos begin to crawl up the inner surface of the bottle where they may readily be seen with the aid of a hand lens, the sheep are moved to another enclosure.

On the Place of Origin and Method of Distribution of Taste Buds in Ameiurus melas: F. L. LANDACRE, Ohio State University.

Taste buds appear simultaneously in the extreme anterior portion of the oral cavity

(ectoderm) and on the endoderm of the first three gill arches. Buds always spread posteriorly from these places of origin by discontinuous groups. Those of the pharynx spread back into the oesophagus and are continuous with the buds on the last gill arch. Those of the anterior oral cavity spread back in the mouth by discontinuous groups until they reach the area occupied by the pharyngeal buds and they also spread back on the outer surface of the body by discontinuous groups until they reach the posterior portions of the body.

No buds spread from the pharyngeal group to the outer surface of the body. The first taste buds to appear on the outer surface are continuous with those just inside the lips. All the remaining buds appear in discontinuous groups determined partly by the distribution of the rami of the V. and VII. nerves, but not entirely so. There are six well defined groups of buds on the outer surface of the body and two in the anterior oral cavity distinct from the dorsal and ventral lip buds.

The appearance of buds in the oral and cutaneous areas in detached groups spreading from anterior to posterior seems to indicate the order in which specialized communis fibers reach the surface through rami of the V. and VII. nerves. A comparison of the rami bearing fibers in *Ameiurus* with other types shows a very great degree of variability in the geniculate ganglion of the VII. nerve as to the number of rami through which it may send communis fibers and as to the time at which it sends them in *Ameiurus*. The functional needs of the organism, such as changes in the methods of seeking and locating food, seem to determine the direction of spreading and also to be more important factors in determining the manner of appearance (*i. e.*, in detached groups) than the mere anatomical arrangement of

trunks and rami of the nerves, so that the discontinuous groups may be designated as functional groups.

The Central Reflex Connections of Cutaneous Taste Buds in the Codfish and the Catfish. An Illustration of Functional Adaptation in the Nervous System: C. JUDSON HERRICK, Denison University.

The taste buds which occur in the outer skin of siluroid and gadoid fishes have been thoroughly studied anatomically and physiologically, their innervation worked out and their central reflex connections compared with those of the tactile nerves from the same cutaneous areas. The peripheral gustatory and tactile nerves of the cod and the catfish are the same in principle, with the exception of the location of the most sensitive areas used in the locating of food. This area is on the barbels of the catfish, but on the filiform pelvic fins of the gadoids, particularly the smaller forms, like the hake and tom cod. Correlated with this difference is a striking difference in the course of the secondary gustatory tracts for nerves coming from the cutaneous taste buds. In the catfish the facial gustatory center has migrated forward for ease of correlation with the tactile and motor centers of the barbels, jaws, etc., and there is a broad connection between this facial lobe and the general tactile center in the funicular nuclei, whence a common motor reflex path serves to put both sense organs into relations with the motor centers. In the cod there has been no forward migration of the facial lobe, because the tactile nerves from the most sensitive area come in behind the vagal lobes by way of the spinal nerves. And the secondary gustatory path from the terminal nucleus of the cutaneous taste buds does not connect with the tactile correlation center, but passes directly to the motor centers. This short-circuiting of the reflex path from cutaneous taste buds is

also an adaptation to the different and more active movements made by the cod in feeding.

C. JUDSON HERRICK,
Secretary

(To be continued)

SCIENTIFIC BOOKS

Second Report of the Wellcome Research Laboratories at the Gordon Memorial College, Khartoum. ANDREW BALFOUR, M.D., etc., Director. Department of Education, Sudan Government, Khartoum 1906. Royal 8vo. 255 pp., 21 plates, 106 figures.

The functions of the Wellcome Research Laboratories founded by private munificence are thus expressed in the language of the foundation:

(a) To promote technical education; (b) to promote the study, bacteriologically and physiologically, of tropical disorders, especially the infective diseases of both man and beast peculiar to the Sudan, and to render assistance to the officers of health, and to the clinics of the civil and military hospitals; (c) to aid experimental investigations in poisoning cases by the detection and experimental determination of toxic agents, particularly the obscure potent substances employed by the natives; (d) to carry out such chemical and bacteriological tests in connection with water, food stuffs, and health and sanitary matters as may be found desirable; (e) to promote the study of disorders and pests which attack food and textile producing and other economic plant life in the Sudan; (f) to undertake the testing and assaying of agricultural, mineral, and other substances of practical interest in the industrial development of the Sudan.

The first report of these laboratories covered the history of its work up to January, 1904; the second, now before us, brings the record down to the early part of 1906. The director, Dr. Andrew Balfour, assisted by a staff of five or six scientists, has achieved a piece of work that from every standpoint deserves the highest praise. The difficulties of scientific work in a region so far removed from supplies and necessities, to say nothing of conveniences, one where "native helpers have proved to be only broken reeds," "not to be

trusted beyond the bottle washing stage," can not easily be over-estimated. Despite this the field covered both in territory and in topics investigated, is so broad and the results presented in the report so extensive, that only the most important can be noted here.

F. V. Theobald, the consulting entomologist, has written a fine chapter on the mosquitoes, as well as others on human, animal and vegetal pests. E. E. Austen, of the British Museum, London, has contributed also a valuable chapter on blood-sucking diptera from the Anglo-Egyptian Sudan.

The work reported by the director himself is full of interest. It begins with a record of mosquito work in Khartoum and the Anglo-Egyptian Sudan. By the persistent work of the mosquito brigade anophelines have been practically abolished and the town kept in a fairly satisfactory condition, one vastly different from that which used to obtain. "At Khartoum the subject is complicated by the presence of mosquito-carrying steamers, boats and barges. Were it not for these, success would have crowned the efforts at extinction." For about \$350 in 1905 Khartoum was kept free from malaria, and to a very large extent also from the annoyance which usually adds so much to the discomforts of life in the tropics; a trivial expense for such immunity.

Of other biting insects the distribution of *Glossina morsitans*, the carrier of trypanosomiasis in animals has been found to be somewhat general in the southern Sudan, and *G. palpalis*, the vector of the human trypanosome, has been positively identified from the extreme southern limits of the country. Valuable data are given on the habits of other biting insects, including the Congo floor maggot, and the true jigger, or Chigoe, not heretofore reported from the Sudan. Some records of ticks and an extended discussion of *Aphis sorghi* and of locust swarms, and their destructive work as well as of their parasites, are worthy of note.

A haemogregarine from the jerboa, or desert rat, which was the first to be found in mammals, is described in detail and well illustrated. It is similar to one since reported by Captain Christophers in India. The free motile stage was observed only three times, but

cysts and the merozoites were regularly found in the liver and kidney. Interesting forms from the jerboa flea which were at first regarded as developmental stages of this haemogregarine were found on further investigation to be in reality parasites of the flea itself. Other forms from small mites (*Dermanyssus*) which infest the jerboa may prove to be the developmental stages sought. Another very interesting series of observations concerns a leucocytozoon of mammals, obtained from the blood of a Norway rat, although it could not be found in numerous examinations of the blood from many Egyptian rats.

Trypanosomiasis in the Anglo-Egyptian Sudan received careful attention. In the region south of the tenth parallel of latitude it certainly exists to a very considerable extent, affecting donkeys, horses, mules and possibly camels. This is not the species, *Trypanosoma nanum*, found in cattle. Of the latter disease the report discusses at length its symptoms and post mortem findings, as well as its morphology and inoculation experiments. Similar though more extended records are given for an undetermined species from mules which is probably identical with *T. dimorphum*.

One very interesting chapter embraces the report of the traveling pathologist and naturalist, Sheffield Neave, who spent four months in the field in southern Sudan. His chief effort was to locate the natural source of infection with the tropical blood parasites. In all he made 750 blood films, from 55 human subjects, 118 other mammals, 69 birds, 33 fish, 6 amphibia, and 18 sheep ticks. Trypanosomes were found in man, the mule, four fish, and two birds. Filariae were found in five birds, *Halteridium* in eight, and a new *Hæmamæba* in one. All of these forms are described in detail. Many insects and a few plants were collected on the trip, and numerous data recorded regarding the tribes with which he came in contact.

The chemist of the Wellcome Research Laboratories gives a valuable chapter on a multitude of subjects from the chemical composition of Nile waters to the use of asbestos in ancient burial, and new forms of chemical apparatus. It would be impossible even to

cite all, but the extended study of gum arabic, its varieties, occurrence, uses, grading, determination of viscosity, etc., and the careful examinations of Nile waters are investigations of fundamental importance.

The work is well printed and splendidly illustrated. One hundred and six fine text figures and twenty-one full-page superb colored plates add greatly to the scientific value of the report.

Such rich results reflect great credit upon the director and his staff and furnish a most ample justification of the generosity and foresight of the founder. Institutions more favorably outfitted and conveniently located may well be jealous of their laurels when such reports as this appear.

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A 1671 ENGLISH VERSION OF NICOLAUS STENO'S DE SOLIDO INTRA SOLIDUM NATURALITER CONTENTO, BY H. O.

THE recent reprinting of Steno's classic 'Prodromus' in Germany has revived the interest in this seventeenth century anatomist and geologist and in the few scarce editions of his remarkable treatise. His famous tract which appeared in Latin at Florence in 1669 was, according to Professor von Zittel, reprinted in Leyden in 1679 and a French translation was brought out by Elié de Beaumont in 1832, but neither von Zittel nor the booklists to which I have had access make mention of an English translation of the book. Just recently there fell into my hands an evidently little known English version printed in London in 1671, with the following title-page:

The | Prodromus | to a | Dissertation | Concerning | Solids Naturally Con- | tained within Solids. | Laying a Foundation for the Ren- | dering a Rational Accomp't both of | the *Frame* and the Several *Changes* of | the Masse of the EARTH, as also | of the various *Productions* in the same. | By Nicolaus Steno. | English'd by H. O. | London, | Printed by F. Winter, and are [sic] to be Sold | by Moses Pitt at the White- Hart in | Little Brittain, 1671.

There are sixteen pages of preface with the title-page, and 112 pages of text and one plate; the size of the printed part of the page measures 2.75 inches wide by 5.5 inches high.

Why has this translation been overlooked and who was H. O.?

I am not aware that any writer on the history of geology specifically refers to having seen or read this translation. The copy in the writer's possession is bound up as a separately paged tract at the end of a small volume of the celebrated Robert Boyle's 'Essays of Effluvium,' etc., containing also his 'Essay about the Origine and Virtue of Gems' of 1672. A general title-page gives reference to Steno's work. This title-page is dated 1673. All of the contained tracts appear to have been separately printed at different dates between 1671 and 1673, at which last date they were brought out in the form above described.

The translation appears to have passed out of sight in the same century for John Ray, elected to the Royal Society, 1667, who rewrote his now curious 'Three Physico-Theological Discourses' in 1693, twenty-two years after the H. O. translation appeared, does not mention either the original *Prodromus* or this translation of it. Had he known either work probably Ray would not have quoted in his second edition (pages 156-157) Steno's earlier 'Description of a Shark's Head' to the neglect of the most important scientific contribution to the discussion of the origin of fossil shells and geological structures which was extant in his time. It is difficult to account for Ray's reticence unless by reason of his living outside of London. But the publication of the H. O. translation of Steno's 'Prodromus' as an appendix to Boyle's prolix essays was from the start likely then as now to bury the work out of the sight of any writer on geological subjects.

As for H. O., the translator, he reveals himself in a preface of six pages entitled 'The Interpreter to the Reader' as having recently received a copy of the original Latin work from Italy, as meeting and hearing a declaration from 'the excellent Robert Boyle,' as being familiar with his opinions and writings, and as well with 'Mr. Robert Hook,' his

occupation in the 'rebuilding of the city of London, and his attendance on the R. Society,' from which account it is to be inferred that H. O. also was much about the Royal Society, and his dealings with Boyle who was one of the founders of that institution strengthens this opinion. We know that during these years Henry Oldenburg¹ was secretary of the Royal Society. It is further known that Boyle was in the habit of employing persons to translate works from one language into another at his expense. Oldenburg's initials attached to this translation, his conversation with Boyle concerning the latter's *Essay on Gems*, of which interview he states that Boyle "before he would see or hear anything of that *Prodromus* of Steno, did upon occasion declare to the author of that English version the sum and substance of what is deduced at large [regarding gems] in this tract," and the consociation of Boyle as founder and Oldenburg as first secretary of the Royal Society at this time and of H. O.'s translation with Boyle's 'Essays' make it highly probable that Henry Oldenburg (c. 1626-1678) englished Steno's 'Prodromus.'

In the interests of a wider acquaintance of many English-speaking students with the path-breakers of modern geology and paleontology the H. O. version of Steno's 'Prodromus' might deservedly be reprinted.

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SOCIETIES AND ACADEMIES

THE SOCIETY FOR EXPERIMENTAL BIOLOGY AND MEDICINE

THE twentieth meeting of the Society for Experimental Biology and Medicine was held in the Rockefeller Institute for Medical Research, on Wednesday evening, February 20. The president, Simon Flexner, was in the chair.

Members present—Adler, Burton-Opitz, Calkins, Carrel, Conklin, Emerson, Ewing, Field, Flexner, Foster, Gibson, Gies, Lee, Levene, Levin, Mandel (J. A.), Meltzer,

¹ See *Encyclopedia Britannica*, 9th ed., Vol. 17, page 439, Vol. 22, page 401, and index volume.

Meyer, Murlin, Noguchi, Opie, Salant, Wolf, Yatsu.

Member elected—C. Ward Crampton.

Abstracts of Original Communications¹

Experimental Studies on Nuclear and Cell Division: E. G. CONKLIN.

Extensive experiments were made on the segmenting eggs of *Crepidula plana*. These experiments included a study of the influence on nuclear and cell division of hypertonic and hypotonic sea water, of ether, alcohol, etc., of the lack of oxygen, of the electric current, and of pressure and shaking. Many important conclusions were reported and numerous drawings shown.

Heterotransplantation of Blood Vessels:

ALEXIS CARREL.

The author's method consisted of removing a segment of the abdominal aorta of a cat, and of reestablishing the circulation in the lower part of the aorta by interposing a segment of the jugular or carotid of a dog and suturing it to the cut ends of the aorta. It was found that a segment of a dog carotid which had been transplanted in a cat could act as artery for seventy-eight days at least.

Transplantation of the Kidney with Implantation of the Renal Vessels in the Aorta and Vena Cava: ALEXIS CARREL.

The transplantation of the kidney with implantation of the renal vessels in the aorta and vena cava consists of extirpating from an animal a kidney with its vessels, together with a segment of the aorta and vena cava; also of transplanting the kidney into the abdomen of another animal and suturing the edges of the patches to the edges of suitable openings made in the walls of the aorta and vena cava. The author used this method mainly on cats and obtained excellent results from the standpoint of restoration of the circulation. Of seven animals operated on, six remained in good

¹ The abstracts presented in this account of the proceedings have been greatly condensed from abstracts prepared by the authors themselves. The latter abstracts of the communications may be found in Number 3 of Volume IV. of the society's proceedings.

condition. The seventh died of intestinal intussusception four days after the operation.

Secondary Peristalsis of the Esophagus—a Demonstration on a Dog with a Permanent Esophageal Fistula: S. J. MELTZER.

Injections of indifferent solutions or of air directly into the esophagus cause there a regular peristaltic movement. This latter form of peristaltic movement, which for the sake of brevity the author terms *secondary peristalsis*, differs essentially from *primary peristalsis*, that which follows deglutition, through the nervous mechanism by which it is controlled. The secondary peristalsis requires the presence of some sort of a bolus within the esophagus, and presupposes the integrity of the latter; whereas the primary peristalsis requires neither a bolus nor the integrity of the esophagus. Even if a large section of the latter is removed, the peristalsis appears in the lower segment in due time after each deglutition as long as the vagus nerves remain intact.

The author demonstrated both forms of peristalsis in a dog with a permanent fistula in the upper half of the cervical esophagus.

Peristaltic Movements of the Rabbit's Cecum and their Inhibition, with demonstration: S. J. MELTZER and JOHN AUER.

When a well-fed rabbit is fastened on its back on a holder and the hair of the abdomen is removed, as a rule movements of the cecum can be seen sooner or later. The movements are well marked and characteristic in their appearance, and leave no doubt as to the organ in which they take place. As a rule, especially in well-fed rabbits, the movements begin in the colon and travel towards the small gut, that is, they are antiperistaltic in character. But frequently at the end of an antiperistalsis, after only a short interval, the wave returns and runs from the small gut towards the colon; in other words, the antiperistalsis is often followed by a peristaltic wave. The constriction is preceded by a bulging which is more marked than the former. The degree of the constriction (and bulging) is variable. Weaker waves sometimes do not finish the course. A complete course of a wave in one direction lasts from thirty to fifty seconds.

The average rate of the movements is about one per minute, but the rhythm is far from being regular. Various influences suppress cecal peristalsis. Ether applied through the nose stops the movements but they return in about a minute after the ether is removed. Pain, struggle and fright stop the movements; but they soon return again. The most striking effect, however, is the one caused by opening the abdomen: the peristaltic movements as a rule disappear completely and permanently.

The authors found that stimulation of the cecum by exposing it to abnormal conditions is capable of inhibiting its movements directly. Laparotomy abolishes the movements of the cecum by direct inhibition, assisted probably also by reflex inhibition. Cecal peristalsis ceases after cutting both vagi. Stimulation of the peripheral end of one vagus causes a tetanic contraction of the entire cecum, especially after destruction of the cord. Some of the above mentioned facts were demonstrated on an animal with destroyed cord.

Deglutition through an Esophagus Partly Deprived of its Muscularis, with demonstration: S. J. MELTZER.

The author demonstrated a dog drinking milk in perfectly normal manner against gravity from a bowl on the floor, although a large section of the path of deglutition was deprived of all muscle fibers. The author stated that he had completely removed the muscularis from the entire cervical esophagus of a number of dogs. On the day after the operation they drank milk and water like normal dogs. In these cases there were no muscle fibers for quite a long distance to do the slow work of pushing the liquids into the thoracic esophagus. They were apparently squirted through the cervical esophagus by a muscular force located anteriorly to the esophagus. That this force is not due to the constrictors of the pharynx was demonstrated by another experiment. In one dog, besides the removal of the esophageal muscularis, the middle and lower constrictors of the pharynx were cut and completely put out of function.

This dog, also, drank without any difficulty the day after the operation. The throwing force is apparently exercised by the muscles of the mouth and tongue.

The function of deglutition is provided with a mechanism for a rapid squirting down of appropriate materials. As to which of the mechanisms comes into play in any specific case depends upon the nature of the material which is swallowed.

Immunity Against Trypanosomes: F. G. Novy. (See proceedings of Section K of the American Association for the Advancement of Science, this volume, p. 693.)

On Secondary Transplantation of a Sarcoma of the Rat: SIMON FLEXNER and J. W. JOBLING.

The results of this series of experiments² show that secondary inoculation succeeds in a high percentage of the rats in which no visible metastases can be seen, and in which visible metastases, in the lungs chiefly, are present. These facts bear upon the view expressed by Sticker, that a primary tumor protects the body from the development of a secondary tumor until the period of metastasis arrives, and upon Ehrlich's negative results in secondary transplantations of a rapidly growing mouse carcinoma. The sarcoma studied by the authors is characterized by its infiltrative growth, but it increases far less rapidly than the most active of Ehrlich's tumors, and reaches, in relation to the size of the rat, no such large size as the latter does in proportion to the size of the mouse.

On Certain Chemical Complementary Substances: HIDEYO NOGUCHI.

A comparative study of complement and extract lysins under the same conditions, with numerous important results.

Effects of Experimental Injuries of the Pancreas: ISAAC LEVIN.

The author's results lead to the conclusion that the injuries of the pancreas that produce the gravest effect on the organism are those which cause the most serious interference with the circulation of that organ. To pro-

² Reference to the previous series was made in SCIENCE, 1906, XXIV., p. 766.

duce a fatal disease it does not suffice to interfere partly with the free secretion of the pancreatic juice into the intestines as in the first series of experiments, or to injure some of the parenchyma and at the same time allow the juice to secrete into the peritoneal cavity, as in the second series. The interference with the circulation must be such as to produce a lesion of the whole organ, so that not only will the organism be deprived of the normal function of the pancreatic cells, as after extirpation of the organ, but also every cell will become diseased and begin to act abnormally and injuriously to the organism.

The Pathology of Function: an experimental laboratory course: HAVEN EMERSON.

An outline of experimental procedures comprising a laboratory course at Columbia University, on some common disorders of function and the physiological methods of detecting them.

The Influence of Alcohol on the Composition of Urine: F. C. HINKEL and WILLIAM SALANT.

The data obtained by the authors are illustrated by the appended summary of results of a long experiment:

TABLE SHOWING THE INFLUENCE OF ALCOHOL (50 C.C. OF 50% OR 70% DAILY) ON THE COMPOSITION OF DOG URINE

Average Daily Output in Grams

	Fore period	Alcohol periods		After period
		50%	70%	
	6 days	6 days	7 days	10 days
Total nitrogen ..	5.5856	4.9066	5.2846	5.2590
Total sulphur ...	0.3368	0.2553	0.2978	
Neutral sulphur .	0.0917	0.1035	0.1402	
Inorganic sulphur	0.2081	0.1334	0.1442	0.2187
Ethereal sulphur	0.0371	0.0185	0.0133	0.0067
P ₂ O ₅	0.8016	0.5526	0.5730	0.6959
Chlorides	0.3872	0.3000	0.3210	0.3631

Spirochæta microgyrata (Löw.) and Mouse Tumors: GARY N. CALKINS.

The author described a tumor taken from the right fore leg of a female mouse. A piece of the tumor weighing about 1½ gram was ground up with normal salt solution (3 c.c. of solution per gram of tumor material) and this was injected under the skin of the neck

in twelve white mice. The remainder was fixed in 10-per-cent. formalin and in Zenker's fluid. One tumor has appeared in the inoculated mice. Dr. Ewing described the tumor from sections as an adenoma with glandular characters of the thyroid. Necrotic areas are few in number and very small; mitotic figures are rare.

Sections of the tumor put through the Levaditi silver nitrate method reveal the presence of *Spirochæta microgyrata*. The spirochæte is not widely distributed, but may be found at various points in the tumor mass, especially in the few small vacuolar areas. It has the characters of the species described by Löwenthal in 1905 in a case of human ulcerated carcinoma.

On the Competency of the Venous Valves and the Venous Flow in Relation to Changes in Intra-abdominal Pressure: RUSSELL BURTON-OPITZ.

In these experiments on dogs, the author measured blood flow in a femoral vein by means of his new recording stromuhr⁴ and suddenly raised intra-abdominal tension either by pressure with the hands upon the external surface of the abdomen, or by inflation of the cavity with air.

In both cases a retardation of the venous inflow was noticed, the degree of the slowing of the blood-stream being in accordance with the increase in the intra-abdominal pressure.

A more abrupt and decisive slowing of the blood stream occurred when pressure was exerted with the hands. It then became possible at times to produce not only a stoppage of the flow, but also a slight backward movement, such as can be accounted for by the stretching of the venous valves.

On Vaso-motor Nerves in the Pulmonary Circuit: RUSSELL BURTON-OPITZ.

Various carefully devised experimental procedures failed to reveal vaso-motor influences in the pulmonary circuit.

The Effect of Salicylic Acid upon Autolysis: L. B. STOOKEY.

The liver, kidney, spleen and muscle taken from dogs which had received subcutaneously

⁴ This volume, p. 422.

doses of sodium salicylate (0.1 gram, in 1-percent. solution, per kilo of body weight) daily during a period of ten days, showed rates of autolysis greater than those observed in organs taken from normal dogs.

On the Synthesis of Protein through the Action of Trypsin: ALONZO ENGLEBERT TAYLOR.

The author subjected to tryptolysis 400 grams of protamin sulfate obtained from the spermatozoa of the striped bass. The resultant products, freed from sulfate and concentrated to the point of saturation of the solution containing them, were treated with 300 c.c. of a glycerol extract of livers of large soft-shelled California clams, which contain a strong, stable, tryptic enzyme. The mixture was treated with toluol and set aside in a sealed flask. This solution, which was clear at the beginning, gradually became opalescent, then cloudy and finally a white precipitate settled out. This mixture was found to contain a large quantity of protamin. The author presented numerous chemical facts in support of his conclusion that protamin was regenerated in this mixture from its non-protein hydrolytic products.

A Method for Separating Leucin from Amino-valerianic Acid: P. A. LEVENE.

Separation of leucin from amino-valerianic acid was accomplished by means of lead acetate and ammonia. A basic lead salt of leucin, insoluble in hot water, was formed. From a mixture containing 52.53 per cent. of C and 9.39 per cent. of H, by the use of these reagents, a substance was obtained which had 54.55 per cent. of C and 9.90 per cent. of H. On reprecipitation it acquired the composition: C = 54.70 per cent.; H = 10.09 per cent. Leucin contains 54.89 per cent. of C and 10.01 per cent. of H.

WILLIAM J. GIES,
Secretary

THE BIOLOGICAL SOCIETY OF WASHINGTON

THE 427th meeting was held March 9, 1907, with President Stejneger in the chair. The following communications were presented:

J. W. Gidley: 'A New Horned Rodent from

the Miocene of Kansas.' Illustrated with lantern slides.

W. H. Osgood: 'Notes on European Zoological Gardens.'

C. L. Pollard: 'Dictionaries in their Relation to Biology.'

THE 428th meeting was held March 23, 1907, President Stejneger in the chair. Dr. C. W. Stiles read a paper on 'A Reexamination of the Type of *Filaria restiformis*, an Alleged Parasite of Man.' He exhibited the original specimen of *Filaria restiformis*, described by Leidy in 1880. A reexamination of this type has developed the fact that the worm is not a *Filaria*, but a member of the family *Mermithidae*. It was certainly not a parasite in the genito-urinary apparatus of man as originally described and, in all probability, was not a parasite of man at all. The original material is in the Army Medical Museum, Washington, D. C. As it can not be determined generically, Dr. Stiles has proposed to place it in the collective group *Agamomermis* as *A. restiformis*. A more detailed account together with drawings of the original specimen will appear later.

Mr. Lyster H. Dewey read a paper on 'The Zapupe Fiber Plant of Eastern Mexico.' Zapupe is a name applied to two species of *Agave* cultivated in the states of Tamaulipas and Vera Cruz, Mexico, and also to the fibers produced by these plants. Many large plantations comprising a total of more than 4,000,000 zapupe plants have been set out during the past four years. Although these plants have been called Tamaulipas henequen and Huasteca henequen, they are quite distinct from the henequen plants of Yucatan. Both have rigid straight leaves 1 to 2 m. long, but they are narrower, thinner and more numerous than henequen, *Agave rigida elongata* (Jacobi) Baker, or sisal, *A. rigida sisalana* Engelm. Both have small marginal up-curved spines. One, called 'Zapupe verde,' has light green leaves and very sharp terminal spines grooved at the base. The other, called 'Zapupe azul,' has bluish glaucous leaves and terminal spines, usually with an irregularly diamond-shaped

flattened area on the face, but without groove or channel. Zapupe azul, in habit, form of leaf and spines seems to agree perfectly with Tequila azul, *Agave tequilana* Web., cultivated extensively in the region of Tequila, Jalisco, for the production of 'Tequila wine.' The plant is not used for the production of liquor in eastern Mexico. It is said to have been introduced in that region and its origin seems uncertain. Zapupe verde has long been cultivated for fiber by the Indians of Tautoyuca, Vera Cruz. The zapupe fiber morales made by these Indians are among the finest to be found in Mexico. This plant may be *Agave angustifolia* Haw. which has been referred somewhat doubtfully as a synonym of *A. rigidula*.

The fibers of both species of zapupe are very similar in character. They belong to the sisal group among the hard fibers used for twines and cordage. They are finer, and more flexible than either Yucatan or Bahama sisal, approaching the better grades of Bahama sisal in general character. In a test for tensile strength they compare favorably with the better grades of sisal.

M. C. MARSH,
Recording Secretary

DISCUSSION AND CORRESPONDENCE

THE FIRST SPECIES RULE

I HAVE read with a great deal of interest all that has been more recently published in SCIENCE on this topic, because the adoption of and strict adherence to the rule making the 'first species' the generic type will make about as many changes in the nomenclature of the lepidopterous family in which I am especially interested as can well be crowded into it. It will bring up names that have dropped out of use for fifty years and it will completely change the conceptions of a large number of genera that have been in common use for nearly or quite as long a period.

I was particularly interested in the essay by J. A. Allen in the April 5 number of SCIENCE and especially in the following, on p. 548:

Of course, an author often states that certain species are referred to a given genus provisionally, or are given as doubtfully belonging to it. In all such cases the rules of our standard codes prohibit

the taking of any such doubtfully referred species as the type of a genus.

Ordinarily when an author characterizes a genus he has some definite idea that represents his genus—a combination of structures which, taken together, make his generic conception. Whenever there is any change in this association by extension or limitation the genus as first proposed is no longer in existence. As limited or enlarged the association of species represents the conception of the person that limits or extends.

In 1890, in a revision of the species listed under *Agrotis* in our catalogues, I proposed the name *Rhynchagrotis* for an assemblage most prominently characterized by a palpal structure that bore a resemblance to a short snout or beak. There were other characters as well and the combination of those characters made up my genus for which no type was designated.

Among the species referred to this new association was *Agrotis chardynii* (*gilvipennis* Grt.), an oddity in our fauna, standing by itself and differing markedly from all our other forms. It did not really agree with my definition of *Rhynchagrotis* and so I stated; my reason for placing it there being that I believed it would prove to be properly referable to an exotic genus to which I did not care to risk making a synonym.

In accordance with my usual practise in revisional work I prepared a table of species, and for convenience in tabular arrangement I usually separate the oddities first. Thus, *chardynii* being the only one of our species with yellow secondaries was the first to be excluded in the synoptic arrangement, and the list of species described under *Rhynchagrotis* begins with that name.

Recently, Sir George Hampson, in his monumental catalogue of the Phalaenæ in the British Museum, treated the Agrotids in his Volume IV., and as his basis for generic combinations did not coincide with mine, there were some shifts. Among others my association under *Rhynchagrotis* was broken up, and of all species in the world *chardynii*, which I felt sure could not remain in it, has now become the 'type,' because it happened to

head the list. The name still is *Rhynchagrotis* Smith; but any student who attempts to identify the Smith genus as it stands now, from the Smith description as it was written, will inevitably fail to understand how Smith could have written up such an inapplicable set of characters for his genus. My genus no longer has any existence, though the name proposed by me remains to represent a set of characters specified by Hampson.

It does seem to me as if, when an author has recorded a given set of characters as representing his conception of a genus, any arbitrary rule that limits his generic term to any species or set of species that does not include that combination is both illogical and unscientific. It seems like holding to the letter to avoid an inquiry into the spirit of truth.

JOHN B. SMITH

NEW BRUNSWICK, N. J.,

April 22, 1907

THE ANTHROPOLOGICAL EXHIBITS IN THE AMERICAN MUSEUM OF NATURAL HISTORY

TO THE EDITOR OF SCIENCE: The communication in your issue of April 12, by Dr. Dorsey on 'The Anthropological Exhibits in the American Museum of Natural History' suggests the important question: For whom should the public exhibits in such museums be designed? Should they be for scientists, for college students or for the general public?

The needs of these three groups are so very different that it is quite evident that the same style of exhibit can not be satisfactory to all. If designed for the public the exhibit should come within its comprehension and should lead in a definite manner to a general appreciation of some of the more important features of the subject; for it is to be presumed that the public will see little beyond that which is prepared for them. If they are to obtain definite ideas it is best that the exhibit aim to impart a limited number of fundamentals rather than lose itself in a multitude of details. In other words, effectiveness is dependent on concentration in aim and in limiting the number of objects shown. It is unavoidable that such an exhibit should partake somewhat of the character of a text-book

illustrated by specimens, though it is probably advisable to disguise as far as possible the mechanism of this; for people like better to think they are discovering facts and principles than that these are forced upon them. However, if any considerable portion of the public is to be guided aright it is necessary that the text-book character of the labels shall be at least pronounced enough to be discernible to the trained specialist and consequently to be offensively kindergartenish to him if he imagines that the exhibit was made for him.

An exhibit designed for students having had the advantages of text-book and oral instruction would needs be more advanced, less explanatory, and with a greater wealth of detail.

For an advanced specialist an exhibit of all the material in the museum, each specimen accompanied by its field label, would probably be as satisfactory an arrangement as could be made in exhibition cases; but I am very certain that most anthropologists, like mammalogists and ornithologists, would prefer to have the specimens in trays in storage cases where they could be handled and minutely examined.

The exhibits in our museums twenty or twenty-five years ago were largely of a character that reached no class of people as they should be reached; but catered principally to naturalists. Those were the days when the exhibit expressed what the official occasionally put into words: "The public be d—." Within a very few years it seems to have come to most museums that they were on the wrong track; that their exhibits were not conducive to the best use of the specimens by naturalists and that they utterly failed to reach the public. The keeping open to the public of the halls of a large museum is a matter of great expense, justifiable only on the ground of public instruction, and quite uncalled for if the exhibits are not intended for them.

Most museums are supported to a considerable extent by their communities and therefore the taxpayer has a right to demand that something be done for him; and every fair-minded museum director will see to it that he receives considerate treatment.

If it is conceded that an exhibit for the specialist is of practically no educational value to the public—is to it primarily a collection of meaningless curios—then it is patent that museums drawing largely on public funds can not honestly adopt such an arrangement, but must follow one that will give a fair equivalent for value received.

Museums that may be privately endowed so as to be independent of public funds may, of course, adopt any method they choose; but it would appear to be a foolish waste of energy and money to throw open to the general public a specialists' museum.

The college student is not here considered because his own institution makes special provision for him.

Looking from the standpoint of popular education at the ethnological exhibits of the American Museum, I have been greatly pleased to note the decided advance that the last few years has shown in the matter of arrangement. I can imagine a man of average education, with no special knowledge of the Eskimo or the Plains Indian, viewing those exhibits for an hour and coming away with a fair general idea of the peoples represented, such as he could not possibly have acquired in many hours under former conditions. This man will represent more than ninety per cent. of the visitors to the museum. He it is who is paying a considerable proportion of the expenses of the museum and now is getting his dues. At the same time I presume that the specialist can be amply cared for in this department, as I know to be the case in certain zoological branches.

I hope that there will be no backward step to the condition of storage exhibition with, to the public, its meaningless repetition of specimens that have little or no information to convey.

HENRY L. WARD

PUBLIC MUSEUM, MILWAUKEE,
April 15, 1907

MAGAZINE SCIENCE

THE science in the magazines is not always bad. Much of it is not only most illuminating to the non-specialist mind (including in the

term all those who are specialists in some one subject, but whose college knowledge of all other subjects is wholly antiquated), but is also of the highest order of authority. For instance, the March number of the *Century* contains a very important article by Professor Hugo de Vries on the work of Luther Burbank, and in the May number of the same magazine there appeared one by Professor Stratton on railroad signaling in connection with color-blindness. But the article on color in the number for April belongs to the class of the antiquated and the non-scientific to a degree that has become, fortunately, most unusual. Criticism of an article like this is not worth while, but one can indicate its character by a few quotations. We are told that "two tuning forks of discordant rates of vibration, set in action close together, will make no sound" (as if vibrations of exactly opposite phase were the only ones that give discordant notes); and that "it is possible that the harmonies of color waves may some day be reduced to mathematical tabulation." The writer believes in the 'capacity of brain cells to note rhythmic variations' of various degrees of speed; he affirms that "the brain receives impressions in the form of waves of vibration," and also that "two kinds of light waves are emitted from all objects, color waves and white waves."

After this one is not surprised to find that he thinks there are red-blind individuals who see green, and green-blind individuals who see red, and that, in fact, all the knowledge about color that has been gained in the last twenty years or so is *terra incognita* to him. It seems a pity that three full pages of bright colored illustration should be wasted in propagating error. And this is an article which the New York *Evening Post* took the trouble, upon two separate occasions, to praise! It is said that the *Youth's Companion* employs a reputable scientist whose sole duty is to see that no patently false science, or other matter of fact, appears in its columns. It would be wise if less modest journals followed the same plan.

CHRISTINE LADD FRANKLIN
JOHNS HOPKINS UNIVERSITY

SPECIAL ARTICLES

THE ETHER FREEZING MICROTOME, IN BOTANICAL
TECHNIQUE

THE following description of a freezing microtome, and its advantages, is published in the hope that others will derive such benefits and conveniences as I have for some time enjoyed through its use. The microtome is exceedingly simple, and so easily manipulated that an inexperienced person may quickly learn to operate it successfully. It is very rapid in its work, allowing of sections even in less time than is sometimes required for free-hand sections, and does very efficient work. In some kinds of material the sections are superior to those obtained by the paraffine method. It is useful in dealing with a great variety of objects, and is cheap enough to be within the reach of all.

The freezing method of embedding in section work is well known to all biologists, but owing to the use of faulty or cumbersome apparatus, or to the application toward inappropriate ends, it has not become as general in use as it should be. Osterhout¹ found the freezing method absolutely necessary in the anatomical study of the red sea-weeds. No other freezing apparatus with which I am acquainted combines the good features of the machine described below, and I would especially call the attention of all scientists who have used or are using freezing microtomes to these features. The freezing device is exceedingly simple and effective. The knife carriage is also very simple, is accurate in its work, and although very rigid allows of sectioning on any part of the knife, and at almost any angle, vertical or horizontal with little or no delay in adjustment. This latter feature is especially valuable.

It should, first of all, be explained that it is not the intention of the writer to recommend this method as a substitute for the paraffine method. Messrs. Hill and Gardiner, however,² have developed this freezing microtome technique in the examination of 'connecting threads' of pine tissues to a high degree of

¹ *Bot. Gaz.*, 21: 195, 1896.

² See *Philosophical Transactions of the Royal Society of London*, Series B, Vol. 194, pp. 83-125.

proficiency, and it is to be hoped that their results will be more widely applied. It is not, however, in the study of cytological problems that I have found the technique of most use—though remarkable results have been obtained by Hill and Gardiner—but it is in its use in other lines that it has proved of very great value. The method is capable of application in so many ways, and for such a great variety of purposes that an enumeration of these is deemed advisable. It is chiefly useful for a great deal of work where paraffine sectioning is too slow, and where free-hand sections are difficult to obtain; for example, in sections of certain rust pustules. A great deal of time can often be saved by preliminary sectioning with the freezing microtome before using the paraffine method, in order to determine the condition of the material about to be used. The freezing method can be so developed as to give sections as quickly as, or even in less time than, the free-hand method. The sections, moreover, can be produced in much greater number and are far superior in thinness and uniformity, and in certainty of success. Material can be frozen in eight seconds with an apparatus in good order, so that the embedding can be accomplished in less time than is required for the insertion of the same in pith for free-hand work.

Every mycologist knows how difficult it is to get sections of most fleshy fungi and how almost impossible sections of sporophores of the Tremellineæ and teleutospore clusters of *Gymnosporangium* are, yet these are cut with greatest ease by the freezing method. It is possible to cut a gelatinous sorus of *Gymnosporangium macropus* from tip to bottom together with the hard wood from which the sorus arises, and to preserve it all intact. This seems to me impossible by the free-hand method, and the dehydration in the paraffine method leaves the material in an unsuitable condition for section work. Again, objects of large size can be cut easily, such as small phalloid 'eggs,' entire caps of small agarics, small earth stars, etc., which, if cut at all by the free-hand method would give uneven sections, unless the manipulator is a person of extraordinary skill. I have found

the method of great use in sectioning rust pustules, from both fresh and dried material. It is also of very great value in the study of hard seeds, such as the grains of cereals. The paraffine method, at least as usually practised, is not successful in producing sections of the starchy grains of cereals. Dr. A. Mann, of the Department of Agriculture, however, informs me that he has succeeded by very long infiltration of both xylol and of paraffine in obtaining very satisfactory sections of mature barley grains. By the freezing method excellent thin sections of whole grains (even of large corn) can be cut without difficulty. On the other hand, the method is very useful in cutting hard materials, as small blocks of wood (soaked in water) grass stems, etc. This is made possible by the firmness of the mount, and by the direct and unswerving approach of the knife, which avoids the turning action of the blade, so common in the cutting of free-hand sections from such material. In dealing with such material, moreover, by the paraffine method, dehydration makes the wood so hard that the knife is very easily ruined. In the freezing method, the blocks, on account of their water-soaked condition, are less apt to injure the knife. Again, large soft berries, as cranberries, are easily sectioned whole, and for rapid sectioning of leaves the method is particularly useful. Osterhout's work (*l. c.*) has demonstrated its usefulness in the treatment of red sea-weeds. The method is thus seen to have a wide range of usefulness.

The freezing microtome method should find a place in every botanical laboratory, first as a supplementary aid to the paraffine method, and second, as a quick method of securing sections for ordinary morphological and anatomical work. It sometimes happens that an instructor can obtain only a small amount of material, which may be extremely rare, and by this method he can usually obtain enough excellent sections for a large class in a very short space of time, without the delay necessary for paraffine work, and without the waste of material which is sure to attend the work of sectioning when done by the students. Again, in elementary classes, microtome work

of a difficult nature is sometimes necessary, and the students may be unable to obtain satisfactory free-hand sections. In mycological and pathological laboratories the method is extremely useful. It has, moreover, been found of very practical value in medical pathological laboratories, where it is used in rapid histological work.

Perhaps the greatest general good could be derived from its use in high schools, normal schools and smaller colleges, for which the apparatus for the paraffine method is too expensive, where the time is insufficient, and the courses necessarily too elementary to include the study of the paraffine method. It is especially to workers in these institutions that I wish to direct attention to this freezing microtome technique. The method should prove of immense value in such institutions on account of its cheapness, speed and general usefulness. Hundreds of excellent sections can be cut in a very short time and the apparatus is always ready for use. An efficient apparatus such as that shown in the figure, can be obtained for \$16 (duty free). It is sold by J. Swift & Son, No. 81 Tottenham Court Road, London.



The apparatus is shown in the accompanying figure. The material to be cut is first placed in a ten per cent. gum-arabic solution. It may be soaked in this for one to twenty-four hours, according to the size of the material. It can, when necessary, be kept in the gum arabic for only a few minutes or even a few seconds, though the longer soaking will

give a better infiltration. It is then oriented in a drop of ten-per-cent. gum arabic placed on the small brass plate (*a*) in the center of the table, and a spray of ether is atomized against the corrugated under surface of this plate, producing the necessary low temperature. The atomizer is usually worked by hand with a double bulb, but I have found a compressed-air tank (such as physicians use) a very great convenience, as such a tank allows of the unhindered use of both hands in the microtome work. It also admits of more rapid freezing. I have been able with this apparatus to freeze material in eight seconds on a warm summer's day in Washington, D. C. A foot pump may also be used in place of the double bulb. The knife (*f*) is carried by a shoe (*b*) and is held in place by adjustable screws. The shoe is supported by three bone-tipped adjustable screws, the forward one of which (*c*) is used to set the knife after each stroke in preparation for the next one. The screws rest on a plate-glass top, which covers the table around the central brass plate. The smoothness of motion is facilitated by oil placed on the plate. The atomizer is of the ordinary type. The intake is shown at (*d*), and the ether bottle at (*e*). The ether should be of good quality (that used in medicine for anesthesia) in order to obtain the best results.

The gum arabic may be kept in stoppered bottles, and can be preserved from mold and bacterial attacks by adding a few crystals of carbolic acid or thymol. The sections after cutting can be handled in the ordinary way with section lifters or with small sieve nets of cloth or other substance. The latter method is very useful if the sections are to be transferred to stains and afterwards washed. Very delicate sections may also be handled by means of a loop of fine platinum or brass wire. The sections are caught up in the water drop and are easily transferred to other dishes or to a slide without the injury which is liable to occur in handling with ordinary section lifters. The sections may be mounted in glycerine or glycerine jelly, and can then be permanently mounted, without having touched alcohol if water stains are used. As

Hill and Gardiner point out, the dehydration of sections in alcohol may leave protoplasmic structures in a condition very different from the normal. Of course, the effect of freezing is also one which must be taken into account, though this is seldom, if ever, a serious factor in the morphological and anatomical work for which this method is here recommended. Sections for ordinary anatomical work can be cut from fresh material, or from dry material after soaking in water. The material may also be killed by the ordinary methods, preferably without the use of alcohol, and may then be washed in water in the usual way and preserved indefinitely in a concentrated thymol solution. Such material can be prepared for the knife simply by washing carefully in water.

I wish to acknowledge that my acquaintanceship with the possibilities of the microtome described above was made in the Cambridge (England) botanical laboratory, and I am indebted to Mr. A. W. Hill, of Cambridge University, for many courtesies and favors in my observations and study of this method.

E. M. FREEMAN

U. S. DEPARTMENT OF AGRICULTURE,
WASHINGTON, D. C.

ASTRONOMICAL NOTES

THE YALE PARALLAXES

Transactions of the Astronomical Observatory of Yale University.—Dr. W. L. Elkin, director of the Yale Observatory, undertook, in 1884, by means of the heliometer, the determination of the parallaxes of the ten stars of the first magnitude in the northern sky. This work was carried out with rare ability and success during the following ten years; but before the completion of this work, it was decided to extend the research by undertaking a survey of all rapidly moving stars not previously attempted, with a view to singling out those which are near enough to show a measurable parallax. This work has been carried on during the last thirteen years, and the results have been recently published as Volume II., Part 1, of the Observatory Transactions, under the title, 'Parallax Investigations on 163 stars mainly of Large Proper-

Motion.' The greater part of the observations were made by Dr. F. L. Chase, assistant astronomer, and a smaller number by Mr. M. F. Smith, assistant, and Dr. W. L. Elkin, the director.

It was thought at first that a small number of observations at each of two successive epochs of maximum parallactic effect would certainly show if the parallax amounted to as much as $0''.20$, and give some indication of a value as small as $0''.10$. Later the plan was extended to include two more epochs taken in reverse order. The results were made to depend wholly on measures of distance, and in general two comparison stars were selected on opposite sides of the star whose parallax was sought.

Systematic personal error, due to the direction of the stars, or to differences in color or brightness, was avoided by the use of a reversing prism eye-piece. Also, gauze screens were used to equalize the brightness of the stars to within half a magnitude. For each star in most cases twelve complete observations were made. Every precaution to eliminate known sources of error was employed, so that the authors have good reason to believe the results to be free from systematic error, except, perhaps, one due to color. Such an error seems to be theoretically possible. In order to ascertain whether an error due to this cause is appreciable in actual observations, Dr. Chase made a series of observations on five highly colored stars. The results appear to indicate, that there is a discernible color effect, which is in accordance with theory; but the errors involved are so small that even in extreme cases, they come within the probable errors, never amounting to more than $0''.03$.

All the observations were given equal weight. The effect of poor definition seems to have been inappreciable.

A reliable estimate of the systematic errors of the stars in general is obtainable by a comparison of the Yale parallaxes with those deduced by other able observers. A table of twelve such stars is given from which the average difference between the Yale values and the others amounts to $0''.036$, from which,

assuming equal accuracy for both results, the total probable error of each is $\pm 0''.017$.

The authors do not claim great precision for the individual results, but attach importance to the mean values of various groups which they formed. With the addition of the ten stars of the first magnitude previously determined by Elkin, the number of stars considered is 173, from which five groups were formed. In each group the stars are arranged as indicated in the following mean results.

TABLE I
Results arranged according to Proper Motion

P. M.	Par.	No. Stars.	Mean Magn.
$0''.14$	$+0''.019$	21	3.8
0.49	$+0.032$	39	6.3
0.59	$+0.059$	45	6.7
0.77	$+0.039$	46	6.5
1.50	$+0.109$	22	6.2

TABLE II
Results arranged according to Stellar Magnitude

Mean Magn.	Par.	No. Stars.	P. M.
0.8	$+0.095$	10	$0''.61$
3.8	$+0.066$	29	0.53
5.6	$+0.056$	33	0.63
6.7	$+0.045$	34	0.73
7.6	$+0.017$	31	0.68
8.3	$+0.047$	36	0.80

TABLE III
Results arranged according to Size of Parallax

Par.	No. Stars.	P. M.	Magn.
$-0''.110$	7	$0''.55$	7.3
-0.025	29	0.52	6.4
$+0.031$	66	0.62	6.8
$+0.097$	44	0.79	6.1
$+0.159$	17	0.97	6.3

TABLE IV
Results arranged in order of Right Ascension

R. A.	Par.	No. Stars.	Magn.
0-3	$+0''.074$	2.2	7.1
3-6	$+0.056$	2.0	5.5
6-9	$+0.047$	1.8	6.2
9-12	$+0.021$	2.2	6.2
12-15	$+0.046$	1.7	6.4
15-18	$+0.078$	2.3	6.4
18-21	$+0.039$	3.0	5.4
21-24	$+0.030$	2.1	6.3

TABLE V
Results arranged according to Stellar Spectra

Class.	Par.	No. Stars.	Magn.	P. M.
Type I.	A E G	+0.065 +0.068 +0.125	13 12 4	4.0 6.4 4.0
	I	+0.030	5	5.5
	F L H K	+0.079 +0.040 +0.023 +0.054	30 1 24 5	4.7 4.1 6.5 1.9
Type III.	M Q	+0.007 +0.040	3 2	2.1 2.9
				0.22 0.02

Table I. shows that there is, as might be expected, a distinct relation between parallax and proper motion. Not only are there striking individual exceptions to this law, however, but the group having a mean proper motion of $0''.77$, with a mean parallax of $+0''.039$, destroys the continuity of the series.

In Table II. may be traced some relation between magnitude and parallax. This comparison would have great interest, had the selection of the stars been differently made. As it is, only the first group of ten stars were chosen with reference to their brightness, while all the rest were selected because of large proper motion, that is, in a general way, because of their nearness. Only a hint can therefore be obtained as to the real relation between the magnitudes and parallaxes of the stars as a whole. The table shows that in general bright stars are nearer than faint ones, though even this obvious truth is apparently refuted by the last two groups, which make stars of mean magnitude 8.3 much nearer than those of magnitude 7.6. It must not be inferred that the actual selection was unwise. Any other selection than that employed would probably have led for the most part to negative results. The authors made the best of an extremely difficult problem, perhaps the most difficult in the whole realm of observational astronomy.

Of Table III. the authors say: "This table may also serve to indicate the number of spurious parallaxes belonging to the work. If, according to Newcomb, we regard all the negative results as due to errors of observa-

tion, and likewise an equal number of positive values to balance these, it would seem that all seventeen of the group with parallaxes between $+0''.14$ and $+0''.20$ are real, 38 of those from $+0''.07$ to $+0''.13$ and 35 of those under $+0''.06$. Thus there are 90 stars of the entire list of 163, for which there is considerable presumption that the parallax values found are actual."

Tables IV. and V. appear to lead to results of small importance so far as distribution is concerned.

Finally, a summary is given for the different groups, except for Table III., of the average total stellar velocity relative to the sun, and of the luminosity relative to the sun. In this summary the greater luminosity of the brighter stars is strikingly shown.

Too high praise can hardly be given to these parallax investigations, carried on during so many years. Yet the results, though of great value in themselves, do not encourage the hope that by similar heliometer observations we shall ever gain a knowledge of the distances of any large number of stars, especially of those most distant. It is doubtful if we have, at the present time, any mode of research sufficiently refined to determine the parallaxes of the most distant members of our sidereal system. The quantities involved are too small. By more powerful instruments, especially by photographic telescopes of great focal length, it may be possible to determine smaller values than those yet found. The relation between proper motion and parallax offers a hopeful means for the determination of mean values, but this method has limitations. The relation between magnitude and distance is as yet uncertain. Indeed, the solution of the most difficult parts of the problem calls for some new means of research far more powerful than any known at the present time.

S. I. BAILEY

HARVARD COLLEGE OBSERVATORY

THE AMERICAN ASSOCIATION FOR THE
ADVANCEMENT OF SCIENCE
THE PLATTSBURG MEETING OF THE SECTION OF
GEOLOGY AND GEOGRAPHY

SECTION E will hold a summer field meeting, July 3-10, 1907, in New York State in the

region between Lake Champlain and the Adirondacks.

Dr. Lane, the retiring vice-president, will deliver his presidential address during the meeting. Several informal talks will be given on subjects germane to the field excursions, during the half hours after lunches. Papers may be expected from Professors Fairchild, Davis, Kemp, Cushing, Woodworth, Hudson and others.

Dr. John M. Clarke will give a paper on 'Lake Champlain' including an account of the work of the state in the Champlain Valley which is classic ground in the history of American geology. The region is the field of three great wars and many bloody encounters before them and the records of these events are locked up in some measure in the place names of the country. The section owes much to Dr. Clarke for his careful planning of the meeting so that visiting geologists will see as much as possible of this extremely interesting region.

The program of excursions is as follows:

Wednesday, July 3.—Preliminary trip. Preceding the first day of the regular trips Professor Woodworth will conduct those who desire to visit 'The Gulf' at Corey Hill, Canada, to that locality, passing over the marine beaches along the international boundary. Persons intending to take this trip should reach Mooers the night before. This party will join the other members at West Chazy for the Altoona excursion. As this trip must be made in wagons, the number is limited to twenty-five persons.

Thursday, July 4.—Trip to Altoona, Mooers Junction. Plattsburg to West Chazy by train; drive to Cobblestone Hill; Altoona spillway on Potsdam sandstone; to Altoona delta; thence down the Big Chazy to study the fossil shore lines, to Mooers, where the party will spend the night. Only twenty-five persons can be accommodated in the wagons; others may walk four and one half miles from West Chazy to Cobblestone Hill and the Altoona spillway. Guide, Professor Woodworth.

Friday, July 5.—From Mooers Junction to Chazy. The Chazy limestone in its varying aspects and its faults. If this trip is to be

made it will be necessary to start in the morning, as there is no other train between the two places. Return to Plattsburg in the evening, to Hotel Champlain or the Catholic Summer School. Guides, Professor Cushing and Dr. Ruedemann.

Saturday and Sunday, July 6 and 7.—By steam-launch to Crab Island, Valcour Island and Valcour shore. Extensive displays of Paleozoic sediments with interesting structural features. Return Saturday evening to spend Sunday at Bluff Point, at Hotel Champlain, or the Catholic Summer School. Interesting exposures of the Trenton faulted down against the Chezy and of monchiquite dikes in the limestone, within easy walk of the hotel. Guides, Professor Cushing, Dr. Ruedemann and Professor Hudson.

Monday, July 8.—Plattsburg to Lyon Mountain by rail. The entire day to be given up to the examination of the magnetite mines. It may be possible to make stops at interesting localities: Dannemora, Cadyville, but this will depend upon convenience. Return to Plattsburg. Guide, Mr. Newland.

Tuesday, July 9.—Keeseville; Anorthosite and Potsdam conglomerate; north slope of Trembleau Mountain, Marine delta, and higher lake shores; thence to Ausable chasm cutting the Potsdam sandstone since the retirement of Hochelogan Sea. Return in the evening to Plattsburg. Guides, Professors Woodworth and Cushing.

Wednesday, July 10.—Plattsburg to Port Henry and Mineville iron mines, or to Ticonderoga and the graphite beds. It is not likely that both trips could be made on the same day. Each one will choose which excursion he will take. The Port Henry and Mineville trip will be under the guidance of Mr. Newland, the Ticonderoga trip under the guidance of Professor Kemp.

Thursday, July 11.—If any of those who attend the meeting would like to spend another day in visiting points of interest on Lake George on the way home, Professor Kemp has kindly consented to act as guide for this excursion.

There will be a winter meeting of the American Association in Chicago, when there

will be abundant opportunity for members of the section to present papers. The Plattsburg meeting is one primarily for field excursions.

The Hotel Champlain, charmingly situated overlooking the lake, will accommodate 300 to 400 persons. The rate will be about four dollars a day.

The Champlain Assembly, incorporated as the 'Catholic Summer School of America,' has invited the members of Section E, through its director, Mr. John B. Riley, to be its guests during the meeting. Rooms may be secured at one dollar a day in the buildings of the Champlain Assembly. Members may take their meals at the Champlain Club; breakfast, lunch, or supper, fifty cents; dinner, seventy-five cents. The grounds of the Champlain Assembly are three miles south of Plattsburg and less than half a mile from the Hotel Champlain. Both may be reached from Plattsburg by steam-train or trolley.

A circular will be sent about June 15 to those who plan to attend the meeting. This will give information in regard to railroad rates. The summer excursion rates will doubtless make it possible to secure round-trip tickets for a little more than one and one third single fare.

The sectional committee of Section E extends a cordial invitation to all members of the Geological Society of America and the Association of American Geographers to attend the Plattsburg meeting.

F. P. GULLIVER,
Secretary Section E

NORWICH, CONN.,

April 25, 1907

THE LEICESTER MEETING OF THE BRITISH
ASSOCIATION¹

THE British Association is assured of a hearty welcome to Leicester for its seventy-seventh annual meeting to be held there from July 31 to August 7, under the presidency of Sir David Gill, K.C.B., F.R.S. Leicester is a place of great antiquity, few towns in England having a longer history of uninterrupted activity. Its Roman remains include the 'Jewry Wall,' a remarkable example of brick-

¹ From *Nature*.

work, and some mosaic pavement *in situ*. The geological features of the district are comprehensive, the Charnwood Forest, with its rocks providing many a geological puzzle, being within a few miles of the town. Botanists, too, have a happy hunting-ground there. The local committees and sub-committees are working hard to insure the success of their efforts, and great interest is being shown on all sides in the visit of the association to Leicester. A guarantee fund of more than 3,300*l.* has been raised towards the necessary expenses of the welcome, and this without any public appeal being made. No less than eleven amounts of 100*l.* and upwards are included in this sum.

A call has been made on all the principal halls and public buildings throughout the town for general and sectional use, and it is believed that the arrangements when completed will be most satisfactory in every way. The greatest difficulty the executive committee have had to meet has been the fact that Leicester possesses no town hall or public building large enough for the purposes of the holding of the usual conversazione and general reception of the large number of members and guests anticipated. An ingenious suggestion, however, on the part of the chairman of the executive committee (Mr. Alfred Colson), which has met with the full approval of all concerned, promises to overcome all obstacles, and even to make the proposed conversazione additionally attractive on account of the unique way in which it will be housed. The intention is to utilize the whole of the present museum buildings, including the art gallery and mayoral reception rooms, for the use of which permission has been granted, and to erect on the four sides of the grass square adjoining a loggia or corridor constructed entirely of timber, 25 feet in width, forming a covered promenade about 500 feet in length. The four outer sides will be closed, but the inner sides, overlooking the grass-plot, will be open, and so constructed as to be easily beautified with floral decorations. Internally the loggia will be draped with incombustible material and fitted with electric light and suitable furniture. Besides answering for the reception to be given by the Leicester Literary and Philo-

sophical Society, the structure and grounds, with a military band in attendance, will make a convenient general rendezvous throughout the week.

A further edition of a very interesting work, 'Glimpses of Ancient Leicester,' by a local author, Mrs. Fielding Johnson, is being issued in connection with this meeting, and a handbook by another Leicester lady, Mrs. Nuttall, will be provided. The latter book will contain chapters on subjects of scientific interest prepared by various experts specially for the use of visitors.

Excursions are being arranged to many points of interest in the district, and the Mayor, Alderman Sir Edward Wood, J.P., will issue invitations to an evening fête in the Abbey Park. Sir Samuel Faire, J.P., will give a garden-party, and it may be taken for granted that the social side of the meeting will be well provided for. The comfort and enjoyment of all attending the meeting will not be overlooked, while the objects of the existence and visit of the association will throughout the week have the first consideration and thought.

THE AMERICAN MUSEUM OF NATURAL HISTORY

THE American Museum of Natural History, New York, will hereafter be open to the public free of charge at all times. Mr. Morris K. Jesup, president, has addressed the following letter to Dr. Hermon C. Bumpus, the director of the museum:

From the time of the founding of the American Museum of Natural History—now nearly forty years ago—certain days of each week have been reserved for 'members,' pupils of the public schools, special students and artists, the public being admitted on these days (Mondays and Tuesdays) only on the payment of an admission fee. Although this is almost a universal custom, I am convinced that its continuation by the American Museum is now of doubtful expediency.

This reservation really amounts to the closing of our doors to the public for approximately one-third of the time, and while, for reasons of economy, it may have been necessary during our early history, we should not forget that the American Museum is a municipal institution, it is primarily

for the public, and any regulation that interferes with the general enjoyment of its privileges is contrary to the spirit of its founders and opposed to the wishes of its supporters.

The growth of the museum during the last few years has made it possible to accommodate large bodies of school children without interfering materially with the use of the exhibition halls by adults. Special students are now given laboratory facilities well removed from visitors, and artists have long found every encouragement for their work in private rooms or in portions of the gallery temporarily partitioned off for their use.

It is true that free admission to the museum on Mondays and Tuesdays has long been enjoyed as one of the many 'privileges of membership,' but I thoroughly believe that those who have contributed and are contributing towards the support of this institution are not actuated by selfish motives; they contribute because they believe in the work that the museum is doing and because they derive pleasure from being associated with it.

I wish therefore—and in this I believe I have the support of the entire board of trustees—that until further notice arrangements be made to have the American Museum of Natural History open daily and its exhibition halls absolutely free to all.

In forwarding a copy of this letter to members of the museum, the director says:

The enclosed letter of President Jesup will meet the hearty approval of all interested in the welfare and development of public educational institutions.

When the American Museum was relatively small, and the exhibition halls were consequently often overcrowded, there were valid reasons for restricting the attendance on certain days, but with the recent growth and the provision of special facilities for students and others specially interested, these reasons no longer exist. The attendance is constantly growing, and it is a matter of common remark that those visiting the museum are seriously interested. They are orderly, intelligent and earnest. The museum is not a resort for the idle. The location is such as generally to require the expenditure of considerable time in travel on the part of the visitor, and although the admission fee has been small, it is nevertheless more than many can afford, and hundreds, even thousands, have been turned away thereby.

It is thought that this action on the part of President Jesup is in the line of progress, and it will doubtless add materially to the already large number who are identified with the museum as

members or patrons, since it is in accord with the prevailing ideas that underlie all educational work, viz., that sources of information should not be surrounded by barriers, and that agencies of instruction should be kept constantly active.

Moreover, it should not be forgotten that there are now many privileges extended to members. They receive the *Journal* and, on request, copies of all 'Guide Leaflets.' The member's ticket admits to the evening lectures, which are arranged exclusively for members and their friends, and to the various laboratories, workrooms and other portions of the building not open to the public. The appointment of an instructor, Mrs. Roesler, makes it possible for the guests of members to be received at the museum and shown about the building; or members may leave their children with Mrs. Roesler for a few hours for instruction in the various exhibition halls.

SECOND ANNUAL MEETING OF THE AMERICAN ASSOCIATION OF MUSEUMS

THE second annual meeting of the American Association of Museums will be held at the Carnegie Institute in Pittsburg June 4-6.

Owing to the unavoidable absence of Dr. Hermon C. Bumpus, who has sailed for Europe, the duty of making all arrangements has devolved upon Dr. W. J. Holland, director of the Carnegie Museum, who has associated with himself Mr. John W. Beatty, the director of the department of fine arts of the Carnegie Institute. Those who propose to attend the meeting of the association are requested to communicate directly with Dr. Holland, who requests more particularly that all who intend to present papers at the meeting will inform him at the earliest possible date of the titles of the papers which they intend to present, so that arrangements may be properly made for the program of the meeting.

Hotel accommodations in the city of Pittsburg are ample, and arrangements have been made with three of the leading hotels, which offer the following rates:

Hotel Schenley—European Plan

Single room, one person	\$2 00
Single room, one person, with bath	3 00

For two persons occupying the same room as a special concession, the same rates will be charged as for single occupants.

Hotel Lincoln—European Plan

Single room, one person	\$1 50
Single room, one person, with bath	2 00
Double room from \$3.00 up.	
Double room, with bath, from \$5.00 up.	

Fort Pitt Hotel—European Plan

Single room	\$1 50 to \$3 50
Single room, with bath	2 50 to 3 50
Double room	2 00 to 3 00
Double room, with bath	3 50 to 5 00

The Schenley Hotel, which is very near to the Carnegie Institute, will be made hotel headquarters.

Those who attend the meeting, the sessions of which will begin on the morning of Tuesday, June 4, at 10 A.M., will register in the library of the Carnegie Museum.

It is hoped that not only those who are at present members of the association, but all who are interested in museums and their work will identify themselves with the association. Under the terms of the constitution it is provided that,

Persons actively engaged in the work of Museums may become Active Members on the payment of two dollars per annum, and may become Active Members for Life upon payment of thirty dollars at any one time.

Persons not actively engaged in the work of Museums, contributing five dollars per annum, may become Associate Members.

Each Museum paying not less than ten dollars a year shall be a Sustaining Member of the Association, and through its chief executive officer, or a properly accredited representative, shall be entitled to cast a vote on all matters coming before the Association.

The association already enrolls in its membership nearly two hundred individuals and museums.

The magnificent new buildings of the Carnegie Institute, the home of the Carnegie Museum and the Carnegie Art Gallery, which were dedicated on April 11, will furnish an inspiration to those who attend the meeting. The annual international exhibit of paintings, which will not close until the middle of June, will still be on exhibition. This is regarded by art critics as the finest and most representative display of pictures which has been seen in this country since the time of the Exposi-

tion at St. Louis. It is hoped that all museums of art as well as of science will be largely represented at the gathering, and every effort will be made to make the occasion one of enjoyment as well as of instruction to those who attend the sessions.

All communications relating to arrangements should be addressed to Dr. W. J. Holland, the director of the Carnegie Museum.

THE CARNEGIE INSTITUTION AND A DEPARTMENT OF ANTHROPOLOGY

THE following letter urging the establishment of a Department of Anthropology for the purpose of investigating the problems of anthropology in South America has been signed by practically all students of anthropology in the United States:

APRIL 3, 1907

To DR. R. S. WOODWARD,

President of the Carnegie Institution of Washington, D. C.

Sir:—The undersigned were appointed by the American Anthropological Association, the Archeological Institute of America, the American Folk-Lore Society, the Anthropological Society of Washington, the American Ethnological Society, and Section H of the American Association for the Advancement of Science—the six societies of the United States entirely or mainly anthropological in scope—to discuss the subject of the most important researches that should be undertaken for the furtherance of anthropological science, and to outline a plan of research of such importance as to be worthy of the consideration of the trustees of the Carnegie Institution of Washington.

The committee believes that the isolation of the continent of South America from the great land masses of the old world in recent geological times makes the study of man's appearance on the continent and the development there of the numerous tribes, languages and cultures in early times, a problem the solution of which would be of supreme importance to anthropological science.

In such a research the study of the racial and cultural development of the peoples of this continent and particularly of the con-

tact of this remote area with other parts of the world would be of fundamental importance.

Since it is not likely that any government will take up such an international investigation, and as it is impossible for any of the existing societies and institutions devoted to anthropological research to engage in so extensive an undertaking, the committee respectfully submits the following resolutions to the Carnegie Institution of Washington:

Resolved, That the trustees of the Carnegie Institution of Washington be respectfully requested to establish an anthropological department for the purpose of investigating the problem of the anthropology of South America, with special reference to the lines of contact between the early inhabitants of that continent and other continental areas.

Resolved, That should such a department be established its work should be based on the following four lines of investigation:

1. The antiquity of man in South America with special reference to the discoveries made in the Pampean formations. This work should be in charge of a competent geologist who should make a critical study of the strata in which the human remains have been found for which great antiquity is claimed. Associated with the geologist should be a trained archeologist who should make archeological investigations in the region of the alleged discoveries.

2. While historically no relation has been traced between the cultures of the more advanced tribes of the Andean Highlands and those of Central America, there is a general resemblance in fundamental types which seems to indicate that either a very early connection between North America and South America existed or that the later cultures grew up on the basis of an older type common to both continents. This investigation would require painstaking archeological researches extending from Mexico southward into the most southern regions to which the influence of Andean culture extended. The investigation of the ethnical relation between South America and North America would require particularly an exhaustive study of the early remains extend-

ing from Colombia northward through Central America, toward southern Mexico, to be correlated with the investigations now being carried on in Middle America.

3. Another line of connection between South America and North America probably extended over the Antillean Islands toward the Atlantic coast of the North American continent. The investigations of explorers have demonstrated that Caribbean and Arowak influences extended from southern Brazil northward to the eastern coast of the Gulf of Mexico; and North American archeology makes us suspect the existence of an earlier connection, which may have extended between South America and the southern and central portions of the United States. In this research is involved an investigation of the many scattered and isolated tribes inhabiting the Amazon valley and neighboring regions.

4. While the indications of North and South American contact are fairly definite on some lines, we have much vaguer indications of foreign influence on the Pacific coast of South America, where certain traits of culture, as well as physical appearance, suggest possible contact with the Polynesian Islands. Notwithstanding the vagueness of the indications, this question is theoretically of fundamental importance. Equally uncertain are the indications of relation with the old world on the Atlantic side, but the possibility of contact by way of the Atlantic Islands to Northwest Africa may be considered.

Resolved, That to take up the four lines of research here outlined, an annual appropriation of not less than twenty thousand dollars would be required; and the extension of the work, which would necessarily follow, would make it advisable that an anthropological department, charged with the investigation of the particular problem of the ethnical relation of South America to other continents, should have a continuous appropriation of not less than forty thousand dollars, and that its work should not be limited to a definite number of years, because even now, in the imperfect state of our knowledge, we can see that the solution of the problem will require many

distinct and important lines of research. The work should therefore be continued as long as results of importance are secured in the various lines of research. Respectfully submitted,

(Signed) F. W. PUTNAM, *Chairman*,
for the Archeological Institute of America.

ROLAND B. DIXON,
for the American Folk-Lore Society.

W. H. HOLMES,
for the Anthropological Society of Washington.

A. L. KROEBER,
for the American Anthropological Association.

FRANZ BOAS, *Secretary*,
for the American Ethnological Society, and
for Section H of the American Association for the Advancement of Science.

SCIENTIFIC NOTES AND NEWS

DR. FRANCIS GALTON has been appointed to deliver the Herbert Spencer Lecture for 1907, at Oxford, and proposes to lecture this term on 'Probability the Foundation of Eugenics.'

OXFORD University has conferred its doctorate of science on Dr. A. Graham Bell.

MCGILL University has conferred its doctorate of laws on Professor Ernest Rutherford, who is leaving McGill to accept a chair at Manchester, and the doctorate of science on Dr. H. M. Ami, of the Canadian Geological Survey.

PROFESSORS E. C. PICKERING, of the Harvard College Observatory, H. Poincaré, of Paris; W. Ostwald, of Leipzig, and Ramón y Cajal, of Madrid, have been elected members of the Royal Irish Academy.

PROFESSOR ALBRECHT PENCK, professor of physiography at Berlin, and Professor Max Noether, professor of mathematics at Erlangen, have been elected foreign members of the Academy of Sciences at Copenhagen.

PROFESSOR WILHELM ROUX, professor of anatomy at Halle, has been elected a corresponding member of the Biological Society of Paris.

PROFESSOR J. WIESNER, professor of botany at the University of Vienna, has been made

an honorary doctor of applied science by the Vienna Technical Institute.

THE University of Bologna has conferred an honorary doctorate of philosophy on Professor Augusto Righi, the physicist, on the occasion of the twenty-fifth anniversary of his doctorate.

DR. H. C. VOGEL, of the Astrophysical Observatory at Potsdam, has been awarded the Maximilian order for art and science of the Bavarian government.

DR. GEORGE F. KUNZ, of New York City, has received the decoration of Knight of the Legion of Honor of the French Government in recognition of his scientific work.

PROFESSOR THEODORE W. RICHARDS, of Harvard University, began his lectures at the University of Berlin on May 4.

DR. W. C. FARABEE, who is in direction of an anthropological expedition from Harvard University, has left Arequipa for explorations among the Indian tribes at the headwaters of the Amazon.

PROFESSOR HENRY E. CRAMPTON, of Columbia University, has left New York this week for a second visit to the Island of Tahiti, where he will spend four months in the study of certain terrestrial molluscs.

DR. AND MRS. VAUGHAN CORNISH, who were at Kingston at the time of the recent earthquake, sailed on May 4 for Jamaica to study the physical effects of the seismic shock and the problem of reconstruction. Dr. Cornish will give an account of his experiences to the British Association and the Royal Geographical Society.

CAPT. J. FRANCIS LEBARON will return to the United States in May and resume his practise as a consulting engineer. Capt. LeBaron has been two years in Eastern Nicaragua engaged in a study of the water powers and water supplies.

THE class day address to the graduating class of the Michigan College of Mines was delivered by Dr. Ira Remsen, president of the Johns Hopkins University, on May 3, 1907.

PRESIDENT C. S. HOWE, of the Case School of Applied Science, will give the commence-

ment address at the Massachusetts Agricultural College, from which he graduated in 1878.

PROFESSOR JAMES F. KEMP, head of the department of geology of Columbia University, has been appointed non-resident lecturer in economic geology next year at the Massachusetts Institute of Technology. He will deliver a course of twenty lectures.

DR. E. E. BROWN, United States Commissioner of Education, is to deliver five lectures on the historical development of Connecticut education at the Yale Summer School.

THE Croonian lecture of the Royal Society was delivered by Professor J. B. Farmer, F.R.S., on April 25, 'On the Essential Constituents of the Nucleus and their Relation to the Organization of the Individual.'

THE Cambridge Historical Society will celebrate the birth of Louis Agassiz on May 27. Brief addresses will be made by President Eliot, Professor A. Lawrence Lowell, Professor W. H. Niles, of the Massachusetts Institute of Technology, and others. Letters will be read from surviving pupils of Agassiz, who are unable to be present.

CHARLES H. HINTON, examiner in the Patent Office and known for his publications in mathematics and logic, died suddenly in Washington, on April 30. Mr. Hinton was born in London; graduated from Oxford University, and was sixty-three years old at the time of his death.

M. AIMÉ LAUSSÉDAT, member of the Paris Academy of Sciences and formerly director of the Conservatory of Arts and Trades, has died at the age of eighty-seven years.

DR. N. WAGENER, emeritus professor of zoology at the University of St. Petersburg, has died at the age of seventy-seven years.

DR. HARMER, the superintendent of the museum of zoology of Cambridge University, announces the receipt of a cast of a skeleton of *Diprotodon Australis*, presented by Dr. E. C. Stirling F.R.S., director of the South Australian Museum at Adelaide. Dr. Harmer also records the gift of a valuable consignment

of some nine skeletons and forty skulls and skins of mammals, mostly antelopes, from tropical Africa, presented by Mr. C. B. C. Storey, M.A., of Clare College.

THE Baltimore *Sun* is responsible for the original announcement that "Sir William Ramsay had succeeded in accomplishing what no other chemist has ever been able to do—the segregation of one element from another and the production of copper by the synthetic or combination process from the elements sodium, lithium and potassium. A combination of these elements, when treated with radium vapor, gives as a product copper sulphate, which is readily 'broken down' into copper." This nonsense has been published with headlines on the first page by leading newspapers throughout the country. The Boston *Transcript* publishes an editorial article indicating that it was a breach of confidence for President Remsen to make known the private communication of Sir William Ramsay!

THE department of mammalogy of the American Museum of Natural History has recently acquired by purchase a collection of mammals from China. The series includes 106 specimens, mostly of species the size of a hare or larger, of which 43 are from the Island of Hainan and 63 from the interior of China, near the foot of the Taipashiang Mountains. The latter are all new to the collection, and the Hainan specimens do not duplicate the material previously received from that island.

WE learn from *Nature* that a conference on the teaching of hygiene and temperance in the universities and schools of the British Empire was held in London on April 23. Lord Stratheona presided at the morning session and Sir John Gorst occupied the chair at the afternoon meeting. Sir Victor Horsley, F.R.S., in an address on the method of introducing hygiene and temperance into secondary schools and universities, suggested that an essential reform within the Board of Education is that there shall be such advice given to the Minister of Education as will enable him to grasp the principles of scientific education. It is the business of the state to

see that the code and curriculum of education are arranged on a scientific and common-sense basis, and this will necessarily include the hygiene of common life and instruction in temperance. Sir Victor Horsley contended that we shall not make any headway unless we have expert advice at headquarters. It is clear that the whole system of education requires revision from a medico-scientific standpoint. The following resolutions were unanimously adopted: (1) "That this conference has heard with great satisfaction that instruction in hygiene and temperance is systematically given in the elementary schools of the colonies of the empire, and that there is strong evidence of the value of this teaching. While cordially acknowledging what has been already accomplished in the United Kingdom by certain educational bodies, this conference urges upon all local authorities the necessity of providing that the teaching of hygiene and temperance shall form an essential part of the whole curriculum of education of all children." (2) "This conference is of opinion that to meet adequately the responsibilities of the state towards school children, it is essential that a medical department should be instituted in the Board of Education."

GAS has been discovered in ten counties of the one hundred and five in the State of Kansas. Its history and distribution in the Kansas-Indian Territory field are so closely connected with those of oil as to be almost inseparable. About the year 1860 the numerous shallow oil wells drilled to depths of a few hundred feet in southeastern Kansas yielded traces of natural gas as well as of oil. Twenty years later, gas in small quantities was found in a number of places near Independence. The first good gas well in the vicinity of Neodesha, which is now a center of production of gas as well as of oil, was drilled in 1893. The present production of gas in the Independence quadrangle is enormous. The value of the quantity now annually consumed in the quadrangle alone is estimated to be about \$800,000. More gas sands than oil sands are encountered in the drilling of individual wells. This oil may be found above the gas or below it. The gas is

believed to come mainly from depths of 1,800 to 2,300 feet. Thus far most of the gas has been put to local use. It furnishes the light, fuel and power of practically all the cities and most of the farm communities and is extensively used for fuel in drilling and pumping. It also supplies the city of Parsons and its numerous industrial plants east of the quadrangle. All this, however, forms but a small percentage of the quantity consumed and to be consumed by the manufacturing industries which have grown out of this natural commodity. Of these industries the most important are those producing brick, tile, pottery, glass, cement, zinc and lead.

UNIVERSITY AND EDUCATIONAL NEWS

A BILL is now before the legislature in which provision is made for the erection at the University of Wisconsin of men's dormitories, commons and union, and additional dormitory accommodation for women.

MRS. WILLIAM THAW has given \$50,000 to the Westminster University of Denver.

THE Cavendish Laboratory Extension Syndicate, Cambridge University, has proposed plans for the new laboratory running along Free School-lane, which will cost between £7,000 and £8,300. Towards defraying the cost of this building there is available Lord Rayleigh's gift of £5,000 out of the Nobel prize, and Professor Thomson is able to find £2,000 from the laboratory funds.

DR. A. ROSS HILL, of the University of Missouri, has been elected professor of the philosophy of education at Cornell University, and will become dean of the faculty of arts and sciences in succession to Professor Walter F. Willcox.

PROMOTIONS in the scientific departments of the University of Chicago have been made as follows: Heinrich Maschke, to a professorship in mathematics; Frank R. Lillie, to a professorship in zoology; Robert R. Bensley, to a professorship in anatomy; Edwin O. Jordan, to a professorship in pathology and bacteriology; Leonard E. Dickson, to an associate professorship in mathematics; Charles R. Mann,

to an associate professorship in physics; Robert A. Millikan, to an associate professorship in physics; Henry G. Gale, to an assistant professorship in physics; Lauder W. Jones, to an assistant professorship in chemistry; William L. Tower, to an assistant professorship in zoology; Charles J. Chamberlain, to an assistant professorship in botany; Henry C. Cowles, to an assistant professorship in botany; Howard T. Ricketts, to an assistant professorship in pathology and bacteriology; Norman M. Harris, to an assistant professorship in pathology and bacteriology.

AT Cornell University Hermann Diedrichs has been advanced to a professorship of experimental engineering and Dr. Ernest Albee to a professorship of philosophy.

DR. THOMAS L. WATSON, professor of geology in the Virginia Polytechnic Institute, has accepted the professorship of economic geology in the University of Virginia.

DR. ALBERT ERNEST JENKS has been promoted to the position of professor of anthropology in the University of Minnesota.

MR. GREGORY D. WALCOTT, Ph.D. (Columbia), of Blackburn College, has been elected professor of philosophy in Hamline University.

AT the University of Wisconsin promotions from assistants to instructors have been made as follows: Lawrence Martin, geology; G. M. Reed, botany; Margaret Schaffner, political science; James Milward, horticulture; Conrad Hoffman, agricultural bacteriology; O. L. Kowalek, chemical engineering; F. W. Lawrence, hydraulic engineering. New assistants were appointed as follows: Hally D. M. Jolivette, botany; H. B. Sanford, electrical engineering; K. O. Burker, electrical engineering; L. B. Aldrich, J. H. Baker, D. S. Dye, W. E. Forsythe, O. H. Gaarden, H. J. Plagge, W. F. Steve, all physics; Matthew Michels, butter and cheese scoring; A. B. Sutherland, philosophy.

DR. N. ACH, docent for psychology at Marburg, has been called to the chair of philosophy at Marburg.